TRAFFIC GENERATION AND DISTRIBUTION OF WEEKEND RECREATIONAL TRIPS

JUNE 1964

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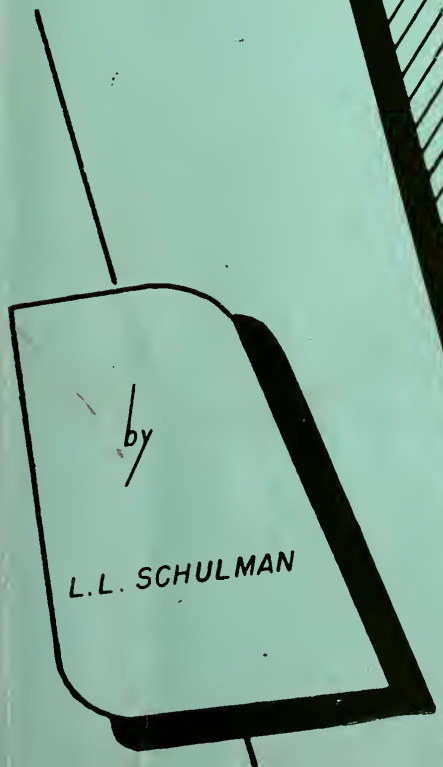

by

L.L. SCHULMAN

Joint Highway Research Project

PURDUE UNIVERSITY
LAFAYETTE IN[illegible]A

TRAFFIC GENERATION AND DISTRIBUTION OF

WEEKEND RECREATIONAL TRIPS

TO: K. B. Woods, Director
Joint Highway Research Project

June 19, 1964

FROM: H. L. Michael, Associate Director
Joint Highway Research Project

Project: C-36-54CC
File: 3-3-29

The Final Report on the research entitled "Traffic Generation and Distribution of Weekend Recreational Trips" is attached. This research has been conducted by Mr. Lawrence L. Schulman, Graduate Assistant on our staff, under the direction of Professor W. L. Grecco. The project was approved at the July 1, 1963, meeting of the Advisory Board.

The Indiana Department of Conservation and especially the Division of State Parks cooperated in the collection of the data.

The purposes of the study were to determine a mathematical model which would distribute trips made to a recreational center to their area of origin and to determine a model which would predict the number of weekend recreational trips which would be attracted to an area. The results of the study include a limited-use distribution model and a ten term multiple regression attraction model. The latter model indicates the important factors in a park which tend to attract auto trips.

The report is presented for the record as the final report of this research. In addition to the normal distribution, it is requested that permission be granted to send copies of the report to the Indiana Department of Conservation.

Respectfully submitted,

Harold L. Michael

Harold L. Michael, Secretary

HLM:bc

Attachment

Copy:

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Final Report

TRAFFIC GENERATION AND DISTRIBUTION OF WEEKEND RECREATIONAL TRIPS

by

Lawrence L. Schulman
Graduate Assistant

Joint Highway Research Project

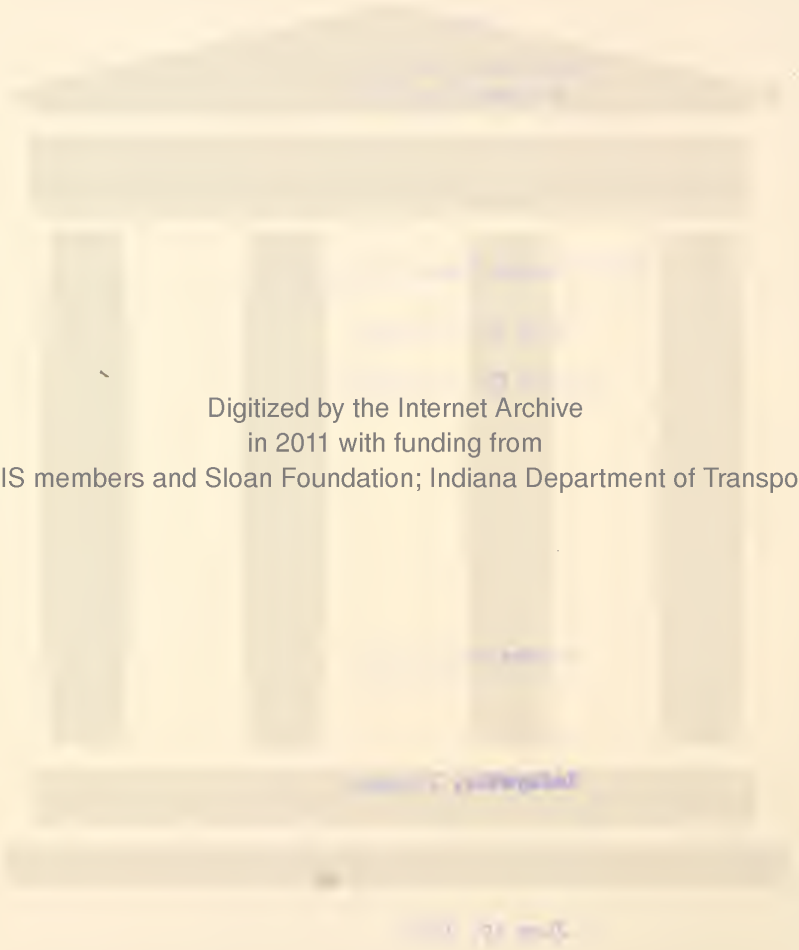
File No: 3-3-29

Project No: C-36-54CC

Purdue University

LaFayette, Indiana

June 19, 1964



ABRIDGMENT

Schulman, Lawrence Leonard, "Traffic Generation and Distribution of Weekend Recreational Trips." Thesis, Master of Science in Civil Engineering, Purdue University, May 1964.

Descriptors: recreational trips; gravity model theory; regression model; weekend arrival distributions; trip attraction.

The object of the study was to define and determine a single exponent gravity model for the distribution of weekend recreational trips and then to test the accuracy of the evolved model in making the theoretical distribution. In this study, the state park was chosen as the recreational area and the residential area was defined as the county. The data were collected for a five week period by means of a license plate study.

Presented in the text are an explanation of the mathematical procedures in the computer solution and a description of the procedures used in choosing the parameters and designing the study. In addition to determining the gravity model, there is presented a regression model which was evolved to predict the number of trips attracted to a recreational area based on its facilities. Also, presented are studies to determine the distance from which 90% of the weekend trips occur, the distribution of weekend arrivals, and the percent of trips arriving on the weekend. Lastly, there is a discussion of a distribution using the gravity model evolved, and some suggestions for future areas of research.

ACKNOWLEDGMENTS

First and foremost, the author wishes to express his sincere appreciation to Dr. William L. Grecco, Associate Professor of Civil Engineering, for his judicious council through all phases of the study and preparation of the manuscript and especially for his encouragement during the ensuing analysis. Appreciation is also extended to Professor Harlley E. McKean, for his assistance in the statistical analysis, as well as his review of the manuscript; to Professor Robert D. Miles for his review of the manuscript; and to Miss Barbara A. McCollough of the statistical laboratory for her assistance with the regression analysis.

Appreciation is also expressed to Professor Kenneth B. Woods, Head of the School of Civil Engineering and Director of the Joint Highway Research Project at Purdue University, for the sponsorship of the research by the Joint Highway Research Project. Without such financial support, this study could never have been undertaken.

Sincere thanks are extended to Mr. Donald E. Foltz, Director of the Indiana Department of Conservation for his permission to use the State Parks and to Mr. Kenneth R. Cougill, Director of the Division of State Parks for his cooperation in arranging the data collection schedule and for giving willingly of his time to answer any questions or supply those records needed. His cooperation was truly an asset to this research.

Lastly, the author wishes to thank the entire Joint Highway Staff for their cooperation and encouragement during the study.

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ABSTRACT

Schulman, Lawrence Leonard, MSCE, Purdue University, June 1964. Traffic Generation and Distribution of Weekend Recreational Trips. Major Professor: William L. Grecco.

Travel for recreational purposes is quickly becoming one of the more important criteria for determining design capacities on many roads throughout the nation. In view of this change, the object of this study was to define and determine a single exponent gravity model for the distribution of weekend recreational trips and then to test the accuracy of this model in making the theoretical distribution. The study of weekend travel was chosen since the results of recent studies indicate that the majority of recreational travel takes place on the weekend.

For purpose of data collection, the state park was chosen as the recreational area and the residential area was defined as the county. The data were collected at five state parks for a five week period during the Summer of 1963. The quantity to be determined was the county of origin of each automobile arriving at the gate and, therefore, a license plate study was performed. A Fortran IV program was written to determine the constants of the gravity model, and a second computer program was used to perform the comparison and the statistical analysis.

It was concluded from the results of the study that a single exponent could not be determined which would satisfactorily distribute a given number of recreational trips to their counties of origin. However, the results

of the study did indicate that a two exponent model could be developed which would accurately distribute these trips. This is based on the findings which seem to indicate that these trips come from two different populations.

Since this model is to be used to distribute a predicted number of trips, two additional studies were performed to facilitate the future use of this model. The first study was performed to determine a model for the prediction of the number of recreational trips that will be attracted to a proposed recreational area. In this study forty-eight variables were used, all of which were based on the characteristics of the park and the characteristics of the surrounding areas. The analysis resulted in a ten term multiple regression model. The second study was conducted to determine the extent of the influence of an individual park. This is needed to determine the area over which a given number of trips should be distributed. The results of this study indicated that not all of the state parks serve the same purpose. Some parks tend to serve only a local population while others can attract from a state-wide area.

In the way of further analysis on the distribution of weekend recreational trips two additional studies were undertaken. The first was performed to determine what percentage of the total number of the recreational trips made during a week occur on the weekend, and the second was performed to determine the distribution of arrivals at the parks on the weekend. This second study determined the percent of arrivals occurring on each day of the weekend, and the peak hours of arrival on each of these days.

INTRODUCTION

Throughout history recreational travel has paralleled the availability of transportation facilities. Before 1800 the three basic modes of transportation were horse, boat or foot, each of which were slow and tedious means of long distance travel. As a result, people in the rural areas hesitated about travelling any substantial distance unless absolutely necessary for survival. The hardship suffered in seeking amusement even a few miles away caused people to shun all travel for recreational purposes. Recreation in the home or with the closest neighbor became the usual practice, with the immediate surroundings being the recreational playground.

Where communities began to grow, travel in and around these areas became practical; however, travel between communities still remained a problem. For most communities, the provision of recreation facilities continued to be a local issue. The immobility of the population, a fact which resulted in the isolation of individuals and groups, created a situation which failed to provide any opportunities for organizing leisure activities on a wide spread basis.

With the advent of the 19th century, recreational transportation was still limited by inconvenience, time, and money. However, with the birth of steam locomotion, steamboat excursions became the popular form of group recreation and a new recreational era was born. At first, this phenomenon was experienced only by the wealthy and more leisured class, but gradually the common man emulated the leisured class. Train excursions to various points of interest followed the same pattern as steamboat

excursions. Places of recreation outside the city began to develop and the populace flocked to the trains on Saturday and Sunday afternoons to escape the congestion of the city.

Near the end of the 19th century electric trolleys began to stretch their intricate network throughout many cities and thereby provided a considerable number of new leisure opportunities for many people. Some transit companies established amusement areas on the outskirts of cities. Others operated special trolley car carnivals at night which included gay illumination and music; while still others provided special transportation to and from municipal and private recreational areas within the city. The low cost of fares, convenience, and ease of travel caused the great masses of people to change their pattern of leisure activity and travel for recreational purposes.

The effect and importance of the accessibility of transportation facilities on the volume of recreational travel is obvious from the changes which occurred during this period. The new methods of mobility were used by people to make their lives more enjoyable through increased recreational activity. Convenient transportation made the population mobile and provided the necessity for public recreation areas. Recreational travel had become a part of the American Culture.

In the 20th century, the pace of recreational travel has continued to spiral. With the advent of the automobile and mass transportation, America has become in reality a country on wheels. The farmer, the day laborer, the merchant, and the executive can all enjoy the use of the automobile for recreational purposes. Increased mobility has lead to the development of new local, state, and national highways and has opened up untold opportunities for recreational pursuits. The once remote state

and national parks, commercial resorts, sea shores, forests, historical landmarks and scenic spots of interest have become well-frequented recreational zones for every class of people.

The use of the automobile continues to surge and with it recreational travel continues to grow. Results of studies have already begun to indicate the importance of recreational travel in determining the capacities of new facilities. In many areas, it has already been found that the peak volumes are occurring on the weekend for recreational purposes and not during the morning and evening journey-to-work hours as was previously assumed (11)*. If the trends continue, the problem of capacities can only become more critical in the future.

The concern with future demand for recreational travel has launched numerous studies and surveys into the area of recreation and what factors cause recreational activities to exist. One of the most comprehensive studies in this area was performed by the Outdoor Recreation Resource Review Commission in January, 1962. According to their projections, the increase in recreational activities over the past years will seem insignificant when compared with the increases which seem imminent in the future.

Figure 1 shows the increase which has been observed during the period from 1951 - 1959 (14). In this period of less than ten years there has been an observed increase of 143 percent in visits to recreational areas. Figure 2 shows the projected increases in several factors which the study found to be indicitive of recreational activity, while Figure 3 shows the existing relationship between one of these factors and recreational participation (17). Similar relationships exist for the other factors and are not likely to change in the future.

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* Numbers in parentheses refer to listings in the list of references.

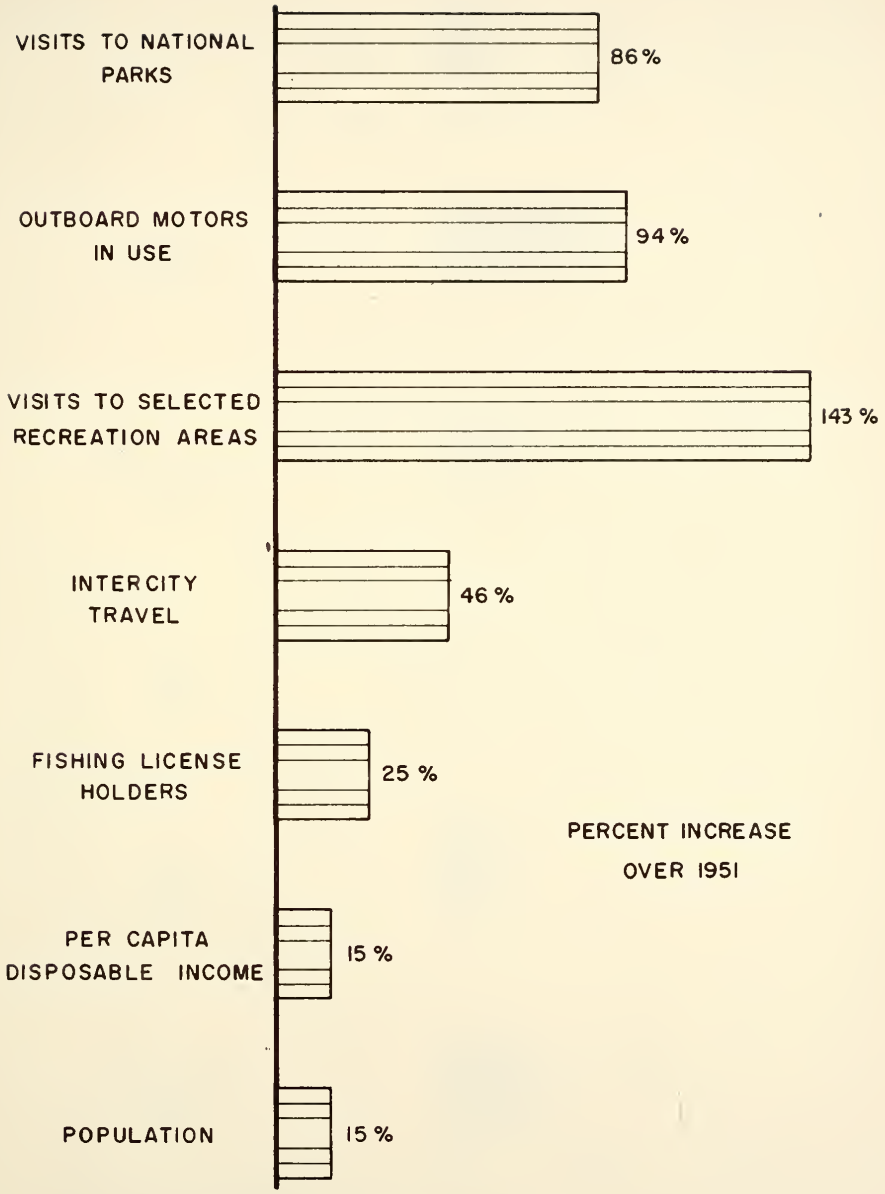


FIG. 1: INDICES OF CHANGE 1951-1959
REFERENCE (14)

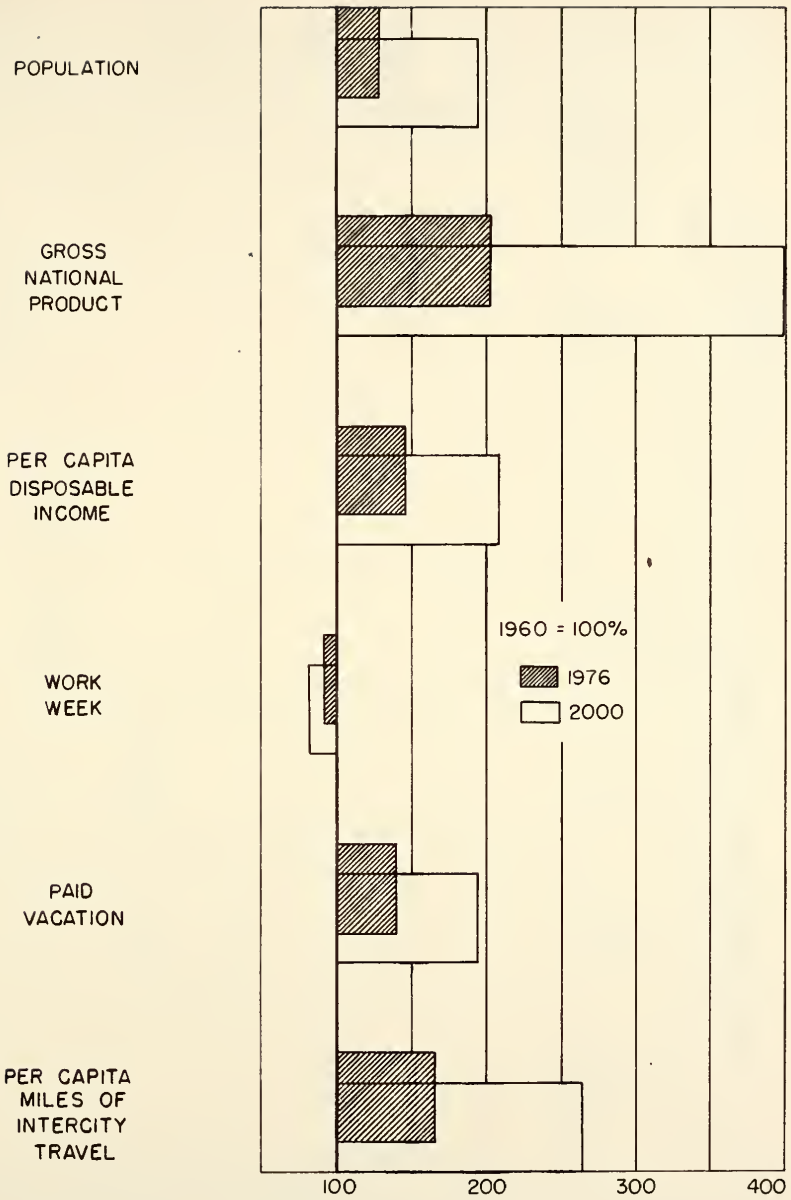


FIG. 2: ESTIMATED CHANGES IN POPULATION, INCOME, LEISURE, AND TRAVEL FOR THE YEARS 1976 AND 2000
REFERENCE (17)

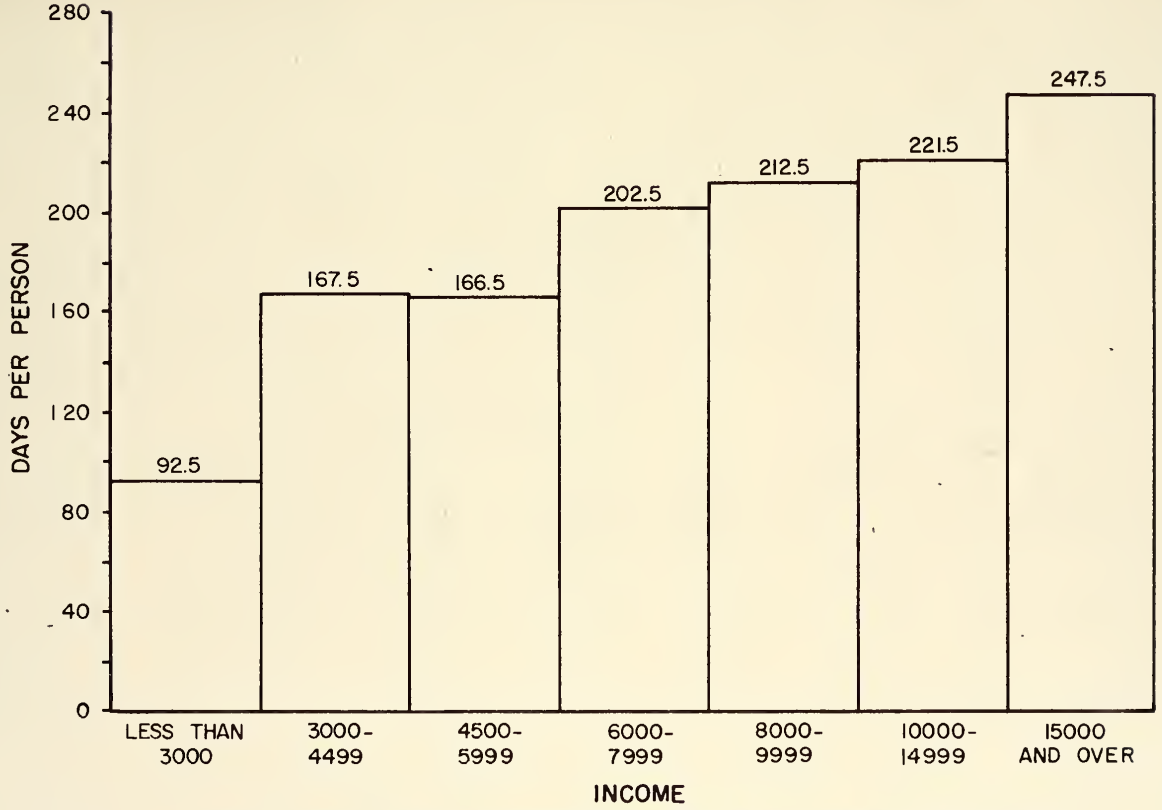


FIG. 3: TOTAL DAYS PARTICIPATION IN OUTDOOR ACTIVITIES BY PERSON AS COMPARED WITH FAMILY INCOME

REFERENCE (17)

The projections in Figure 2 have been made for the years 1975 and 2000. Regardless of which factor is chosen as a measure of the amount of recreational travel, an increase in recreational activity is predicted for the future. Ignoring all other factors, the increase in population alone will double the demand for recreation by the year 2000, but when coupled with the other factors, the anticipated demand will triple.

The results of the study also indicate that the bulk of the recreational demand will have to be satisfied on the weekend and therefore that the weekend recreation trip will be the critical concern in the future. This will be even more critical in the midwest since the results of the study indicate that 39 percent of the weekend recreation trips made in the United States occur in this area. This fact is indicated in Figure 4 (14).

History and Past Usage of the Gravity Model

Many concepts have been developed which attempt to explain or predict human behavior and human interaction. One of the most frequently used concepts has been the gravity model which postulates "that an attracting force of interaction between two areas of human activity is created by the population masses of the two areas and friction caused by the intervening space over which the interaction must take place. This interaction between two centers of population concentration varies directly with some function of the population size of the two centers and inversely with some function of the distance between them" (1).

The gravity concept has been in use for approximately one hundred and fifty years and has survived a history of varied applications and evolutionary changes. One of the earliest applications was made by H. C. Carey during the early part of the 19th century at which time he observed the

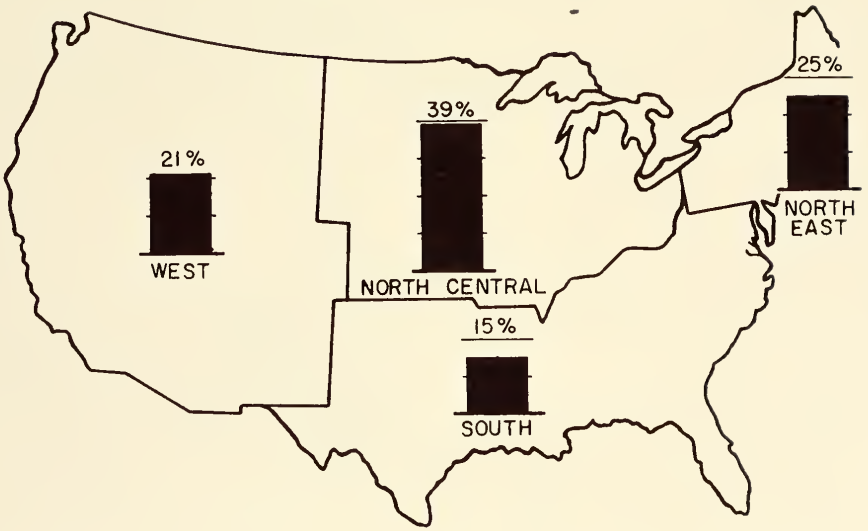


FIG. 4: PERCENTAGE DISTRIBUTION OF AVERAGE WEEKEND DAY VISITS
REFERENCE (14)

presence of a gravitational similarity between social and physical phenomena. However, it wasn't until many years later, in 1885, that the next application was made by E. G. Ravenstein in his attempt to explain migration towards cities. This was followed by another period of non-use until the 1920's when E. C. Young again used the concept in his new explanation of migration. In 1929, one of the most important applications was made by W. J. Rielly in postulating his "Law of Retail Gravitation" (9). In this work he determined that the ability of one area to attract retail trade from another was a function of both its size and the square of the intervening distance. This application has long been noted as the forerunner of our present day applications of gravity models in traffic prediction although the original form has been greatly modified in our present usage. Also in 1930, H. N. Pallin, a Swedish investigator, published a paper in which he stated that the ability of communities to attract trips was a function of the law of gravitation (13).

At this point in its history, the usage of the gravity concept flourished in many disciplines. Numerous scciological applications were made throughout the 1930's and 1940's by many noted regional analysts and urban geographers such as J. Q. Stewart and G. K. Zipf. Also, during this period, many of the evolutionary innovations which are now used in its application to traffic prediction were first questioned and studied. Extensive work was done on the modification of the distance factor by such people as J. D. Carroll, D. O. Price, F. C. Iklè, and T. R. Anderson and on the modification of the population factors by such people as W. Isard and G. Freutels. One of the most influential contributions resulting from these numerous individual studies came in 1955, when Alan Voorhees presented

his form of the gravity model in his paper "A General Theory of Traffic Movement" (7).

In this paper Voorhees presented the concept that the form of the gravity model was a function of the type of trip in question, that is to say, that the distance factor and the measures of the attracting and generating ability of an area were unique for each type of trip in question. The hypothesis was first tested by the application of the theory to shopping trips - both for convenience and shopping purposes. In each case the measures chosen resulted in a model which proved to closely approximate the observed data. The success of this study prompted its application to work trips which again showed the validity of the theory. Next, an attempt was made to apply the concept to social-recreation trips. The application was successful for social trips, but it was impossible to complete the research on the recreational trips because of the lack of background information.

This was nearly ten years ago. To date extensive work has been done in refining the applications of these models to all types of trips, but the research on the recreational travel "has yet to be completed."

Purpose and Scope

This research was concerned with the determination of a gravity model for the prediction of weekend recreational trips. However, before any work can be done with a model of this type, the expression must be clearly and precisely defined for the specific type of trip. It was, therefore, the ultimate purpose of the study to define for a recreational trip, the areas of origin and destination, the variables to represent the parameters of the model and then to determine the required constants. Having determined

the model, a statistical analysis was made on the comparison of observed and calculated trips to check the ability of the model to predict weekend recreational trips.

By definition, a trip of any specified length must represent a spacial movement between two areas - one serving as the origin and the other as the destination of the trip. Therefore, the initial decision in this study was to choose an area of origin and an area of destination for the recreational trip. There are many different types of recreational trips made every week, each with varying destinations; however, in general, the recreational trip will begin at the home. For ease of data collection, the origin of the recreational trips was defined as the county.

Since there has been very little previous work done in this area, the choice of destination for the recreational trip was unrestricted. The choice of state parks was based on the availability and ease of data collection and the importance of this type of recreational trip in the immediate and long-range future. Also, it is possible that the model defined for this type of trip will be applicable to trips terminating at recreational areas constructed in conjunction with water resource projects. This type of facility provides one of the greatest potential areas for recreational development.

At present, there are twenty state parks in the system located throughout the State. See Figure 5. A description of these areas is found in Appendix C.

A. BASS LAKE
B. BROWN COUNTY
C. CHAIN O' LAKES
D. CLIFTY FALLS
E. INDIANA DUNES
F. KANKAKEE RIVER
G. LEIBER
H. LINCOLN
I. McCORMACK'S CREEK
J. MOUNDS
K. POKAGON
L. RACCOON LAKE
M. SCALES LAKE
N. SHADES
O. SHAKAMAK
P. SPRING MILL
Q. TIPPECANOE RIVER
R. TURKEY RUN
S. VERSAILLES
T. WHITEWATER

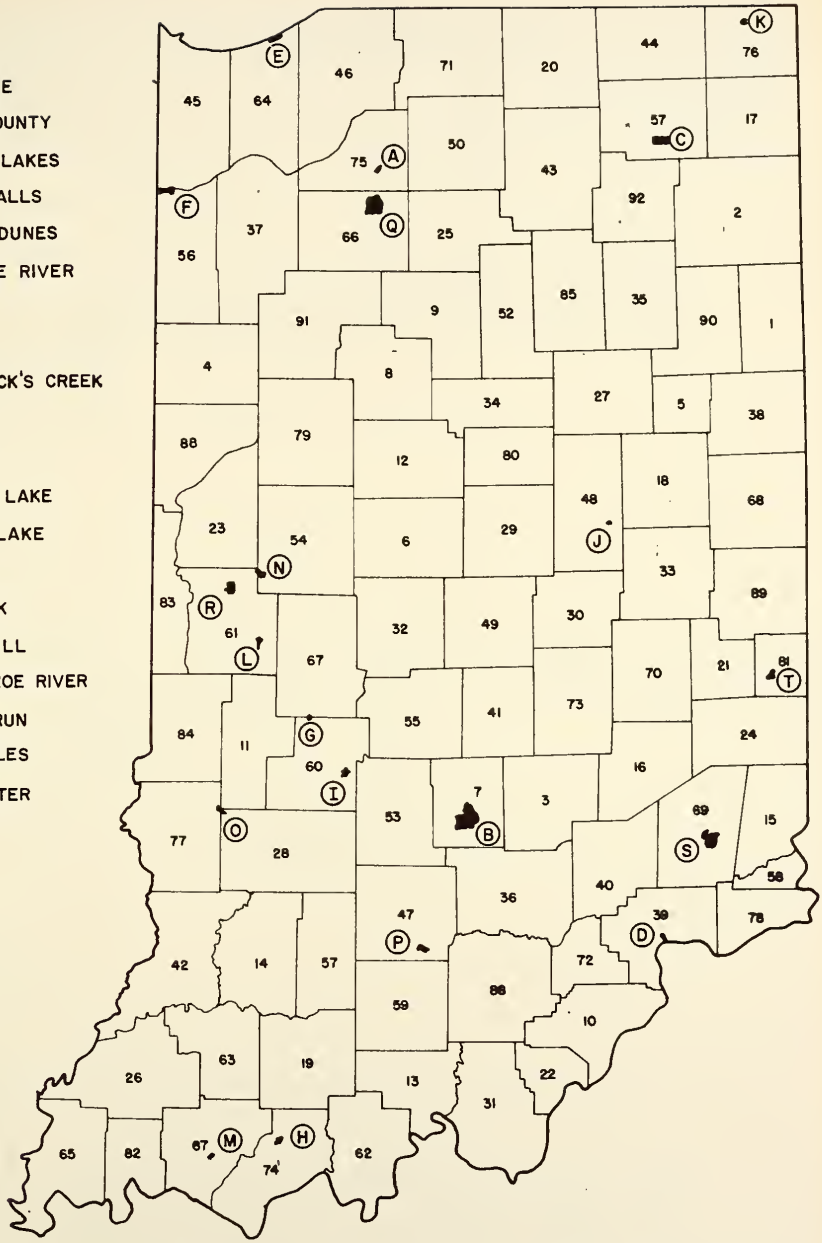


FIG. 5: LOCATION OF INDIANA STATE PARKS AND RECREATIONAL AREAS

Form of the Gravity Model Used

The gravity model used in this work is stated in its simplest form. It returns to the basic statement of the Newtonian gravitational concept and may be stated as follows:

> The number of recreational trips generated by one area and attracted to another is directly proportional to the product of the total trips attracted to the recreational area and the total recreational trips generated from the residential area and is inversely proportional to some power of the distance between the two.

In mathematical form, this statement can be written as

$$T_{ij}' \propto \frac{T_i \cdot T_j}{(D_{ij})^x}$$

The above proportion can be converted to equational form by the multiplication by a computational constant and therefore the computational equation of the model becomes:

$$T_{ij}' = k \frac{T_i \cdot T_j}{(D_{ij})^x}$$

where:

T_{ij}' = the number of automobile trips from residential area j to recreational area i

T_i = the total number of automobile trips attracted to recreational area i from all residential areas

T_j = a measure of the relative ability of residential area j to generate automobile recreational trips

D_{ij} = the road distance between residential area j and recreational area i

x = an exponent which is determined for the type of recreational trip of concern

k = a computational constant

Users of the model in the above form, indicate that the model tends to either over or underestimate the total number of trips attracted to the park. Therefore, the model must be adjusted to the required total by multiplication of the number of trips attracted from each county by a correction factor of the form:

$$C.\ F. = \frac{T_i}{\sum_{j=1}^{n} T_{ij}}$$

where:

$\sum T_{ij}$ = the summation of the calculated number of trips attracted to recreational area i from all of the individual residential areas j

n = the number of counties represented at the park

The need for using the correction factor can be eliminated and the computations simplified if the model is redefined based on the following mathematical procedures.

$$T_{ij}' = k \frac{T_i \cdot T_j}{(D_{ij})^x}$$

where:

T_{ij}' = the uncorrected number of trips from County j to Park i.

$T_j = R_j / \sum_{j=1}^{n} R_j$ and R_j is a measure of the number of recreational trips generated from County j

Therefore

$$T_{ij} = C.\ F.\ (T_{ij}')$$

where:

T_{ij} = the corrected number of trips from County j to Park i.

$$T_{ij} = \frac{T_i}{\sum_{j=1}^{n} T_{ij}'} \cdot T_{ij}'$$

$$T_{ij} = \frac{T_i}{\sum_{j=1}^{n} k \frac{T_i \cdot T_j}{(D_{ij})^x}} \cdot k \frac{T_i \cdot T_j}{(D_{ij})^x}$$

Removing the constant terms from the summation

$$T_{ij} = T_i \cdot \frac{k \cdot T_i \cdot \frac{T_j}{(D_{ij})^x}}{k \cdot T_i \sum_{j=1}^{n} \frac{T_j}{(D_{ij})^x}}$$

and replacing T_j and removing $\sum_{j=1}^{n} R_j$

$$T_{ij} = T_i \cdot \frac{\frac{1}{\sum_{j=1}^{n} R_j} \cdot \frac{R_j}{(D_{ij})^x}}{\frac{1}{\sum_{j=1}^{n} R_j} \cdot \sum_{j=1}^{n} \frac{R_j}{(D_{ij})^x}}$$

the following computational form of the gravity model results.

$$T_{ij} = T_i \cdot \frac{\frac{R_j}{(D_{ij})^x}}{\sum_{j=1}^{n} \frac{R_j}{(D_{ij})^x}}$$

This is the form which is recommended for use.

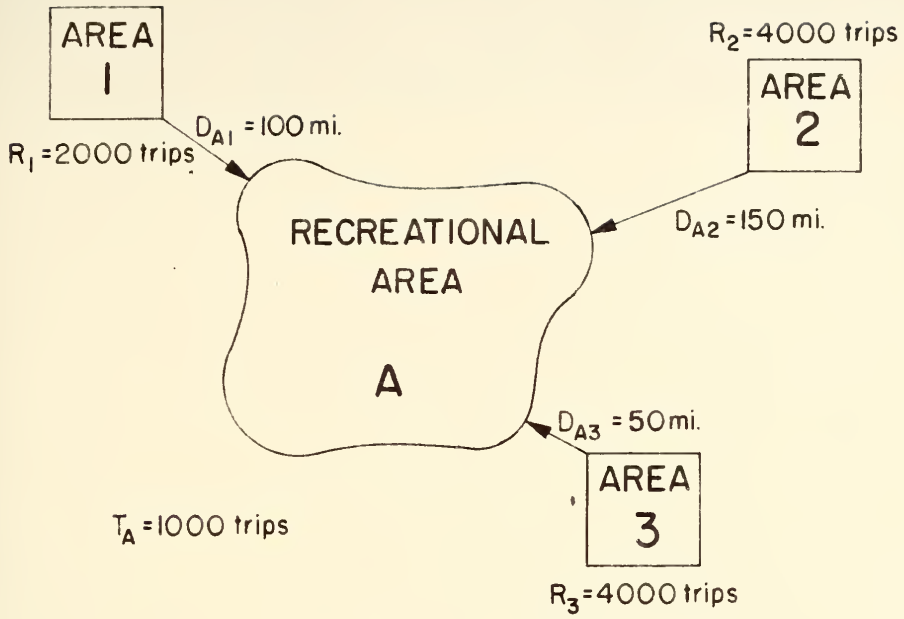
Example of a Gravity Model Distribution

The gravity model is used in the following manner. Assume that we have a system as shown in Figure 6 and we wish to determine the number of recreational trips which proposed Recreational Area A will attract from Residential Areas 1, 2, and 3. Assume also that we have a gravity model of the form

$$T_{ij} = T_i \cdot \frac{\frac{R_j}{(D_{ij})^{1.6}}}{\sum_{j=1}^{n} \frac{R_j}{(D_{ij})^{1.6}}}$$

which has been defined for this type of travel and that we know the total trips that will be attracted to the recreational area, the total recreational trips that each residential area has the ability to generate, and the distance between the residential areas and the recreational area.

In the given example, the Residential Areas 1, 2, and 3 each have the ability of generating 2000, 4000 and 4000 recreational trips of which a total of 1000 trips will be attracted to Recreational Area A. The distance between Residential Areas 1, 2, and 3, and the Recreational Area A are 100, 150, and 50 miles respectively. Having all the variables needed, the quantity $\frac{R_j}{(D_{ij})^{1.6}}$ is computed for each area and the summation of the individual values determined. Next, the proportion between the individual and summed valued is computed for each area and multiplied by the total number of trips to be attracted. The resultant values are the total number of trips generated from each residential area to the recreational area.



AREA 1 $\quad \frac{2000}{(100)^{1.6}} = \frac{2000}{1600} = 1.25 \qquad T_{A1} = 1000 \times \frac{1.25}{10.26} = 122$

AREA 2 $\quad \frac{4000}{(150)^{1.6}} = \frac{4000}{3050} = 1.31 \qquad T_{A2} = 1000 \times \frac{1.31}{10.26} = 128$

AREA 3 $\quad \frac{4000}{(50)^{1.6}} = \frac{4000}{520} = 7.70 \qquad T_{A3} = 1000 \times \frac{7.70}{10.26} = 750$

$10.26 \qquad 1000$

FIG. 6: EXAMPLE OF A GRAVITY MODEL DISTRIBUTION

In our example, these values are 122, 128, and 750 trips respectively for Areas 1, 2, and 3. This totals to 1000 trips, which was the number of trips originally assumed to be attracted to the recreational area.

STUDY PROCEDURES

Determination of the Variables

To determine the constants for the gravity model, data on the four observable quantities had to be determined. They were:

(1) T_j - the total number of recreational trips generated from County j

(2) T_i - the total number of trips attracted to Park i

(3) T_{ij} - the total number of trips to Park i from County j

(4) D_{ij} - the road distance between Park i and County j

For this purpose a field survey was conducted using five of the twenty parks in the Indiana State Park system. These were Brown County, Mounds, Shades, Tippecanoe River, and Turkey Run. The information required was the total number of trips from each county represented at the park. It was, therefore, necessary to determine the origin of each trip being made to the park during the study period. Since only the "county" or origin was desired, it was decided that a license plate study would be best and because the Indiana license plates are prefixed by the county number, the data collection was made with little disturbance to the flow of traffic. The observations were made at the gatehouse while the admission fees were being collected and were recorded by county of origin and by hour of arrival.

The data were collected for five consecutive weekends starting Friday, July 12, 1963 and ending Sunday, August 11, 1963. This time of the year was chosen since it was assumed that in general, peak weekend recreational

travel would occur during the summer months. The observations were not continuous, but were made between the hours of 4:00 to 9:00 PM on Fridays, 8:00 AM to 8:00 PM on Saturdays, and 8:00 AM to 6:00 PM on Sundays. These hours were assumed to include most of the weekend travel. Figures 7 and 8 are samples of the data collection forms. The form in Figure 7 was used for trips originating from within Indiana, and the one in Figure 8 was for trips originating from out-of-state.

The individual trips from county to park were tallied, first by hour, then by day, and finally by weekend. These figures indicate the number of recreational trips for each county to each of the five parks for each of the five weekends observed, or the variable T_{ij} in the model. These observed values are presented in the tables of Appendix A.

The summation of all the T_{ij}'s for a specific weekend and specific park represents the total trips to that park for a weekend or the variable T_i. This approximation is reasonable since most of the trips will arrive during the selected time periods.

Next, some estimate of the number of recreational trips which would be generated by a county was necessary. To date, no satisfactory research has been done in this area, but work has been done in the general area of social-recreational trips. Table 1 shows the results of eleven Origin-Destination Studies (12). These values indicate, that on the average, there is one social-recreational trip per dwelling unit per day. The number of dwelling units in each county was determined from the 1962 County and City Data Book.

The last quantity required was D_{ij}, which is the road distance between the county and the park. It has been a recent practice to replace distance

TRIPS TO STATE PARKS

PARK: Brown County WEATHER: Sunny

TIME: 1:00 - 2:00 PM DATE: August 4 DAY: Sunday COLLECTED BY: Dale E. Orr

1	2	3	4	5	6	7	8	9	10
					II (2)				
11	12	13	14	15	16	17	18	19	20
II (2)	𝍸 (5)								
21	22	23	24	25	26	27	28	29	30
		𝍸 I (6)		IIII (4)		I (1)		III (3)	
31	32	33	34	35	36	37	38	39	40
	II (2)	I (1)	II (2)				I (1)		
41	42	43	44	45	46	47	48	49	50
				I (1)			III (3)	𝍸 I (6)	
51	52	53	54	55	56	57	58	59	60
			𝍸 (5)	I (1)		I (1)			
61	62	63	64	65	66	67	68	69	70
IIII (4)						I (1)			
71	72	73	74	75	76	77	78	79	80
I (1)								IIII (4)	I (1)
81	82	83	84	85	86	87	88	89	90
		I (1)	𝍸 III (8)						I (1)
91	92	93	94	95					
		𝍸 III (8)	I (1)						

FIGURE 7: SAMPLE OF DATA COLLECTION SHEET FOR INDIANA COUNTIES

TRIPS TO STATE PARKS

MICHIGAN-OHIO-KENTUCKY-MISSOURI-ILLINOIS-WISCONSIN

PARK: Shades WEATHER: Clear

DATE: August 8 DAY: Friday COLLECTED BY: Dale E. Orr

TIME	STATE	COUNTY	OUT-OF-STATE
4:00-5:00 PM	Illinois	Cook	
	Illinois	Cook	
	Illinois	Champaign	
	Illinois	Cass	
5:00-6:00 PM	--	--	
6:00-7:00 PM	Illinois	Cook	Iowa
7:00-8:00 PM	Illinois	Kankakee	Florida
	Illinois	Cook	
	Illinois	Cook	
	Illinois	Cook	
	Kentucky	Jefferson	
	Illinois	Cook	
	Illinois	Henry	
8:00-9:00 PM	Illinois	Cook	
	Illinois	Ford	
	Illinois	Cook	
	Illinois	Du Page	

FIGURE 8: SAMPLE OF DATA COLLECTION SHEET FOR OUT-OF-STATE COUNTIES

CITY	PERCENT OF HOME BASED TRIPS	TRIPS/DWELLING UNIT	1960 DWELLING UNITS	SOCIAL-RECREATIONAL TRIPS
Chicago	22.8	5.17	1,214,958	1,432,144
Detroit	20.1	4.67	553,199	519,271
Washington	12.5	4.23	262,641	138,871
Pittsburgh	13.8	4.21	196,168	113,970
St. Louis	21.5	4.90	262,984	277,054
Houston	18.6	5.51	313,097	320,886
Kansas City	22.7	5.14	40,591	47,361
Phoenix	20.0	4.76	143,076	136,208
Nashville	23.9	5.48	53,623	70,231
Charlotte	23.8	5.56	62,142	82,231
Reno	26.3	4.88	19,521	25,054
TOTAL			3,122,000	3,163,281

TABLE I: DETERMINATION OF SOCIAL RECREATIONAL TRIPS PER DWELLING UNIT

with travel time; however, in this study replacement was not deemed necessary. In most cases where this transformation has been made, the trips were internal or interzonal within an urban area; however, most recreational trips, especially those to a state park, are external trips. In contrast to an internal trip, the study of external trips concerns travel on rural roads which for the most part will allow a "free flowing" movement. Therefore, the nature of the rural trip is such that on the average, the total travel time for all trips of a given length will be nearly the same, and the use of total travel time would provide little additional accuracy in the study.

Having previously defined the origin unit as the county, it was assumed that the center of population for this area would be the county seat. This was assumed valid since observations will show that generally the county seat is actually located in the geographic center of the county. The road distances were established by a series of links connecting each county seat. The total distance between each County j and the Park i was the summation of those links which resulted in the shortest trip. Figure 9 shows the series of distance links determined for Indiana. Similar grids were developed for Michigan, Wisconsin, Illinois, Missouri, Tennessee, Kentucky, and Ohio.

Determination of Constants

The model constants were determined from the collected data. In order to compute these values a Fortran IV Program was written for the IBM 7090. The program was written for two purposes. Firstly, nearly 4000 observations were made in the field - a number too large to allow

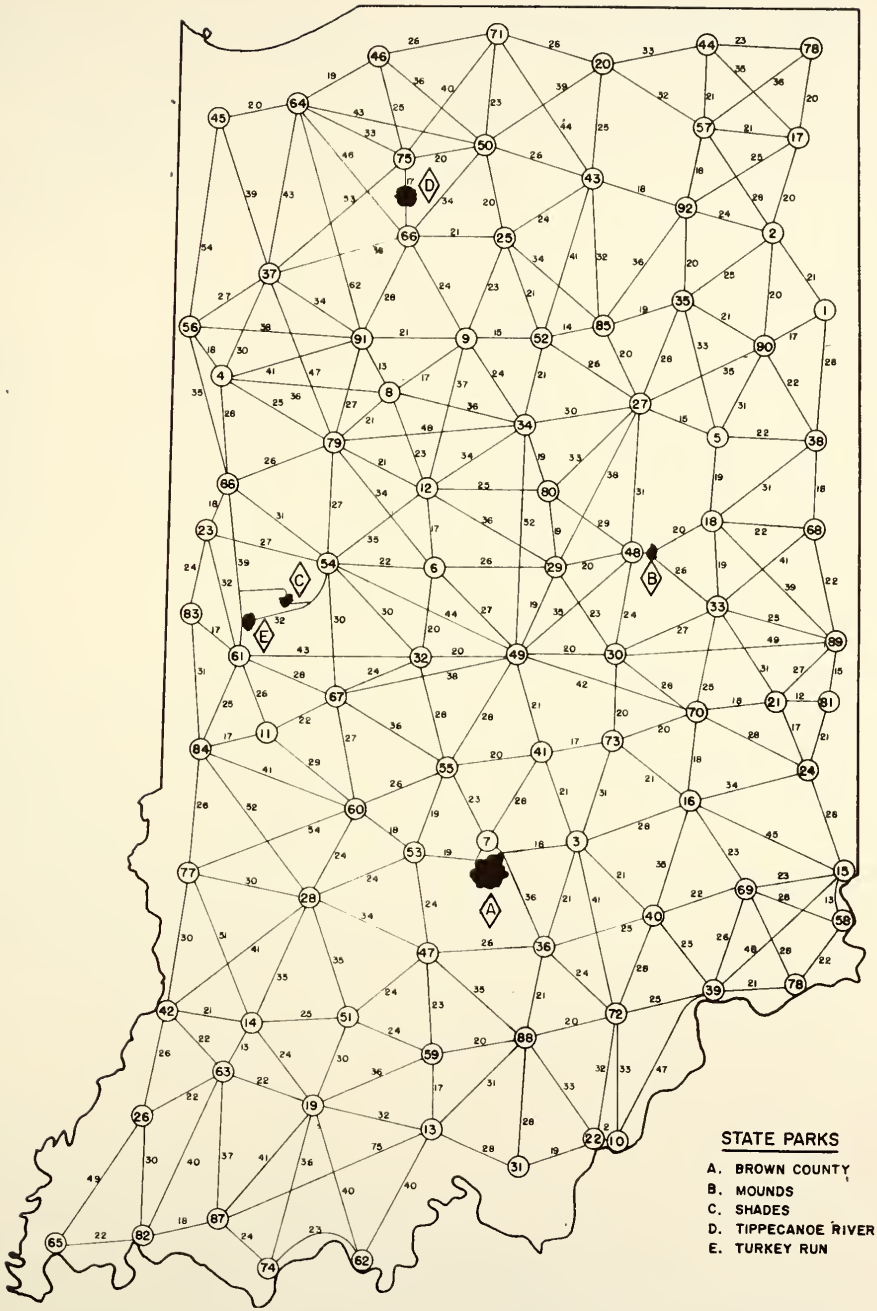


FIG. 9: TRAVEL DISTANCE BETWEEN COUNTY SEATS OF INDIANA

a hand computation. Secondly, the program was written so as to easily facilitate a change in any of the variables.

In essence, the program simulates the following mathematical procedures. The basic gravity model as previously stated, can be rewritten in the form

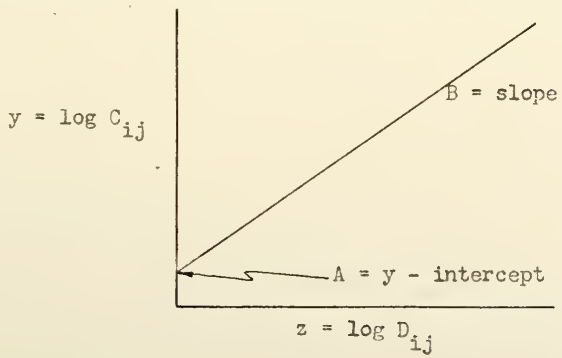
$$K(D_{ij})^x = \frac{T_i \cdot T_j}{T_{ij}} = C_{ij}$$

where D_{ij} is an observable variable; C_{ij} is a calculated variable; and K and x are unknown constants to be determined. For every observation of D_{ij}, there is a corresponding value for C_{ij}. When the log of each side of the equation is taken, the resultant form is:

$$\log C_{ij} = \log K + x \log D_{ij}.$$

This is similar to the general equation for a straight line $y = A + BZ$ where y, the independent variable, is equal to $\log C_{ij}$; z the dependent variable, is equal to $\log D_{ij}$; A, the y - intercept, is equal to log K; and B, the slope of the line, is equal to x.

Theoretically then, a plot of the values of $\log C_{ij}$ and $\log D_{ij}$ should approximate a straight line with the above equation.



In order to determine the slope and the y - intercept of the theoretical line, a simple linear regression analysis was performed. Based on this analysis

$$B = \frac{N(\Sigma ZY) - (\Sigma Z)(\Sigma Y)}{N(\Sigma Z^2) - (\Sigma Z)^2}$$

$$A = \frac{\Sigma Y}{N} - B\frac{\Sigma Z}{N}$$

where:

N = total number of observations

$$Z = \sum_{z=i}^{n_i} \sum_{z=i}^{n_{ij}} \log D_{ij}$$

$$Y = \sum_{z=i}^{n_i} \sum_{z=i}^{n_{ij}} \log C_{ij}$$

and

n_i = number of parks sampled

n_{ij} = number of counties j observed for each park i

Returning to the gravity model, the value x, which is the exponent of the gravity model is numerically equal to B; and K, the computational constant of the gravity model, is equal to the antilog of A.

ADDITIONAL RESEARCH

The previous sections have dealt with the determination of the constant terms in the gravity model. As pointed out, these constants were determined on the basis of field observation of the total number of trips to the park. This procedure was valid for determining the constants, but for prediction purposes this procedure would be impossible since the proposed area would not be in existence at this stage. Therefore, it was necessary to develop a method of prediction of the total trips that will be attracted to a proposed recreational area, and to determine the area over which these trips should be distributed.

Prediction Model for Number of Trips to a Park

To predict the number of trips to the park, a linear multiple regression model was evolved using the characteristics of the area proposed. This decision was based on the feeling that the total number of trips attracted to a recreational area will be some function of its size, facilities, activities and adjacent population.

The model was evolved from the data available for the twenty State Parks, Beaches, and Recreational Areas in the Indiana State Park System. The variables, forty-eight in number, were obtained from various charts and reports supplied by the Indiana Department of Conservation, Division of State Parks, and were compared with the total weekend trips to each of the corresponding parks. This information was obtained from "Weekly Activity Reports" also made available by the Division of State Parks. For this

phase of the study the weekend trips were assumed to be the total of all trips occurring on Friday, Saturday, and Sunday of each week. The sampling time was a thirteen week span beginning with the weekend of June 2, 1963 and ending with the weekend of August 25, 1963.

Because of the magnitude of a linear multiple regression analysis using forty-eight variables, the analysis was performed by computer. A Weighted Regression Analysis Program (WRAP) format was chosen. This format requires that the variables be read into the computer in order of their importance. The data were punched on IBM cards and a first order correlation between the dependent variable and each of the independent variables was determined. On the basis of this correlation, the variables were ordered and input into the computer. Because of the limitations of the format, the regression analysis was performed on the first nineteen most important variables and resulted in the following ten term equation of prediction:

$$Y = -90.36 + 0.61 X_1 - 0.58 X_2 + 3.60 X_3 + 0.22 X_4 - 0.65 X_6 - 0.26 X_9 - 0.73 X_{12} - 43.00 X_{17} + 21.77 X_{18} + 0.11 X_{19}$$

where

Y = Total weekend trips to a park

X_1 = Number of picnic tables

X_2 = Number of campsites

X_3 = Area of the lake (in hundreds of acres)

X_4 = Acres of the park extensively developed

X_6 = Availability of a bath house on premises

X_9 = Capacity of total living facilities (in guest-nights)

X_{12} = Availability of fishing

X_{17} = Location on a river

X_{18} = Availability of electricity

X_{19} = Population within 60 miles of park (in thousands)

The resultant equation using the ten most significant variables had a coefficient of correlation (r) of .926, a coefficient of determination (r^2) of .857 and a standard deviation of 30.9 trips.

In the determination of the above model, many of the forty-eight variables used in the analysis were dichotomous - either they were available at the park or they were not. The remainder of the variables were available in a quantitative form. Where a dichotomy appeared, it was decided to assign the number "2" to the variable, if it did exist at the park, and the number "1" to the variable if it did not exist. This procedure results in a valid form of prediction, but care must be taken to use the same convention when using the regression model in the future. Variables X_6, X_{12}, X_{17}, and X_{18} are dichotomous variables.

Distance for Distribution of Total Trips

The function of the gravity model is to distribute the predicted number of attracted recreational trips from the park to their counties of origin. However, before a distribution can be made, the sphere of influence of a park, or the distance over which a recreational facility has the ability to attract trips, must be determined. Having this distance, the predicted recreational trips can then be distributed among all the counties within the specified distance. For this purpose several curves were developed based on the data collected at the five parks during the field study. For

each park, all the counties represented were arranged numerically by increasing distance from the park and the cumulative percentage at each distance determined. The resulting table and curves show the relation between the cumulative percentage of total trips and the distance within which these trips occurred. These results are shown in Table 2 and Figures 10 through 15.

It is assumed that a small percentage of arrivals at state parks come from an impulse stop of a through driver or a visitor on a social trip to a nearby friend or relative. It was therefore deemed sufficient to account for only 90 percent of the total trips. In Table 2, a distance of zero for 10, 20, and 30 percent of the total trips indicates that 30 percent of the trips have originated from within the county in which the park is located. This infers that Mounds is more of an attractor of local trips than the other four parks which serve much larger areas. It caters to a different type of population and therefore performs a different type of function. This lack of similarity eventually lead to the elimination of Mounds from the analysis of the data, and resulted in a better predicting model.

In view of the above, it seems advisable to disregard the figure of 148 miles as the distance from which 90 percent of the trips originate as indicated in the table. Reevaluation without Mounds show that on the average 90 percent of the total trips will occur from within 152 miles of the park and this is the figure recommended for use.

	DISTANCE					
	BROWN COUNTY	MOUNDS	SHADES	TIPPECANOE RIVER	TURKEY RUN	ALL PARKS
10%	9	0*	13	27	24	15
20%	16	0*	34	34	32	25
30%	27	0*	39	48	49	35
40%	45	5	43	54	63	48
50%	47	16	55	63	67	50
60%	48	32	56	69	78	64
70%	67	35	61	87	106	80
80%	100	48	83	105	131	105
90%	140	81	144	106	161	148
100%	513	291	368	429	590	590

* Denotes trips originating from within county in which park is located

TABLE 2: RELATIONSHIP BETWEEN DISTANCE FROM PARK AND CUMULATIVE PERCENTAGE OF TOTAL TRIPS

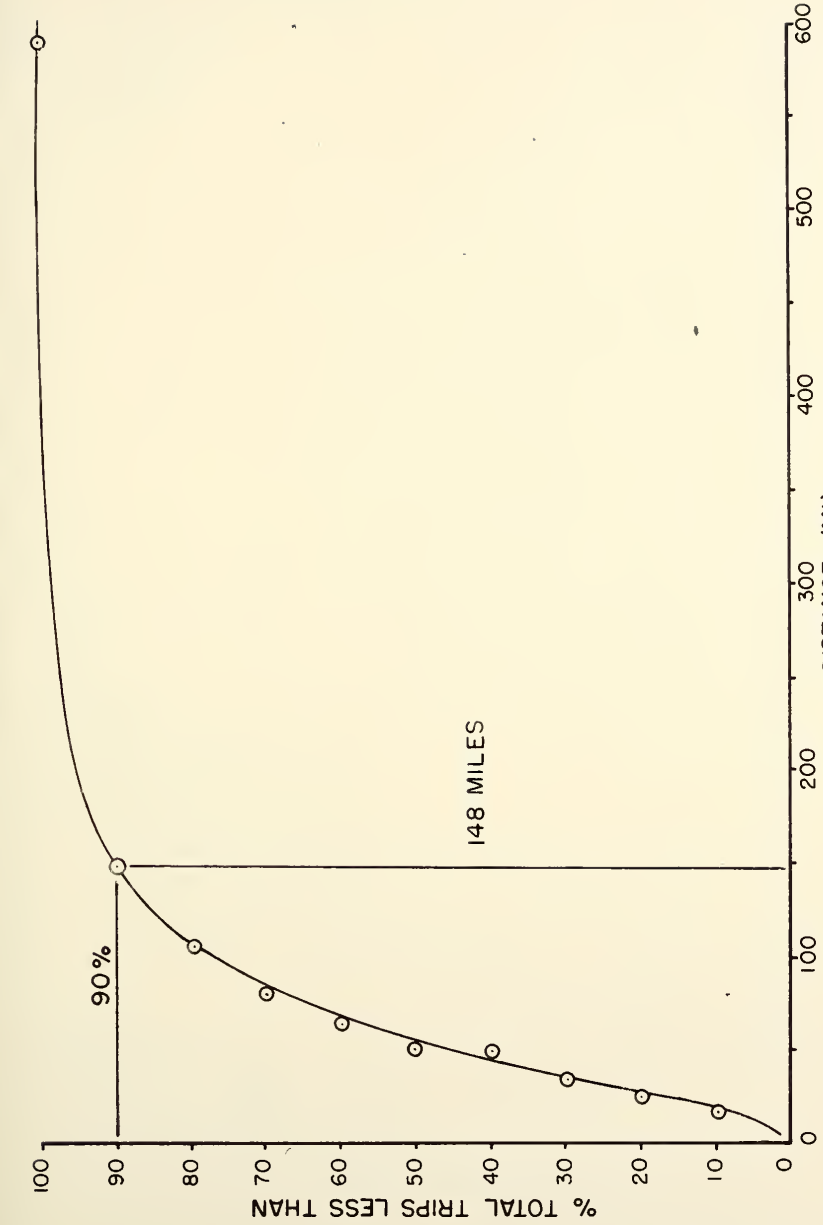


FIG. 10: RELATIONSHIP BETWEEN DISTANCE FROM ALL PARKS AND CUMULATIVE PERCENTAGE OF TRIPS

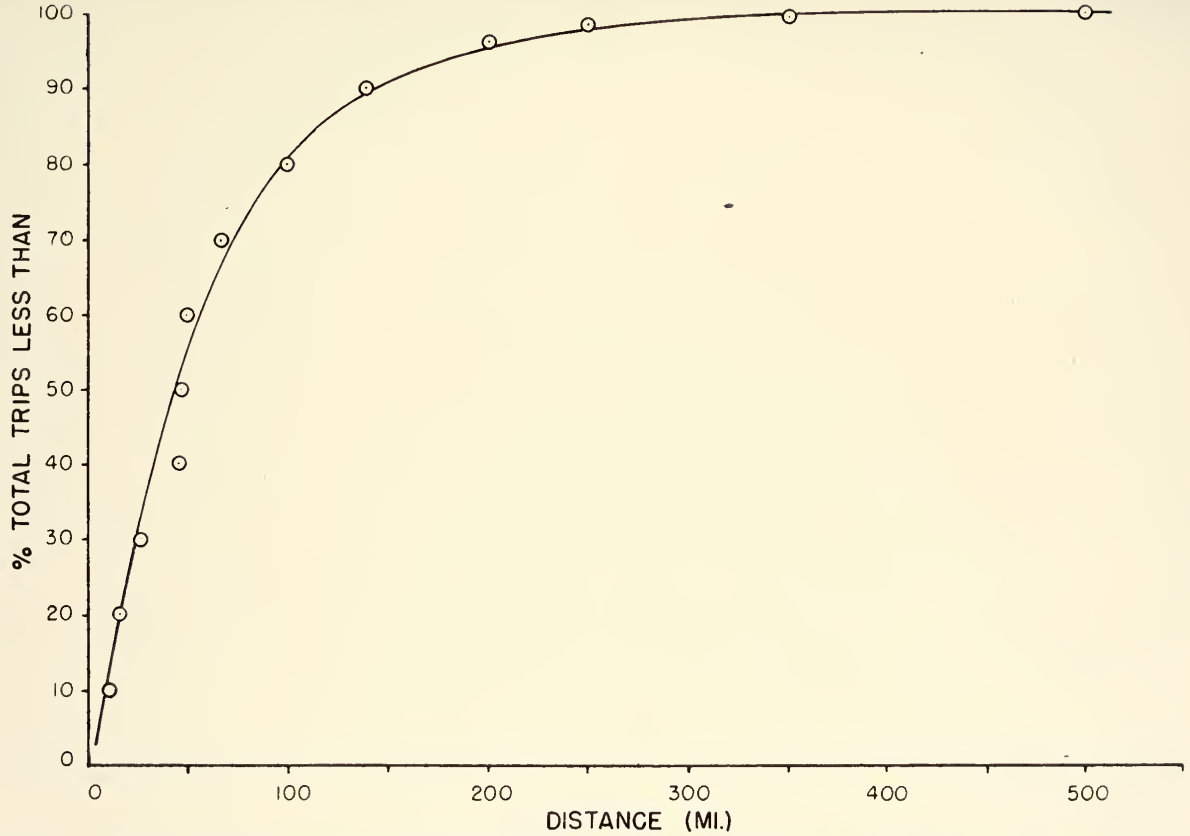


FIG. 11: RELATIONSHIP BETWEEN DISTANCE FROM BROWN COUNTY AND CUMULATIVE PERCENTAGE OF TRIPS

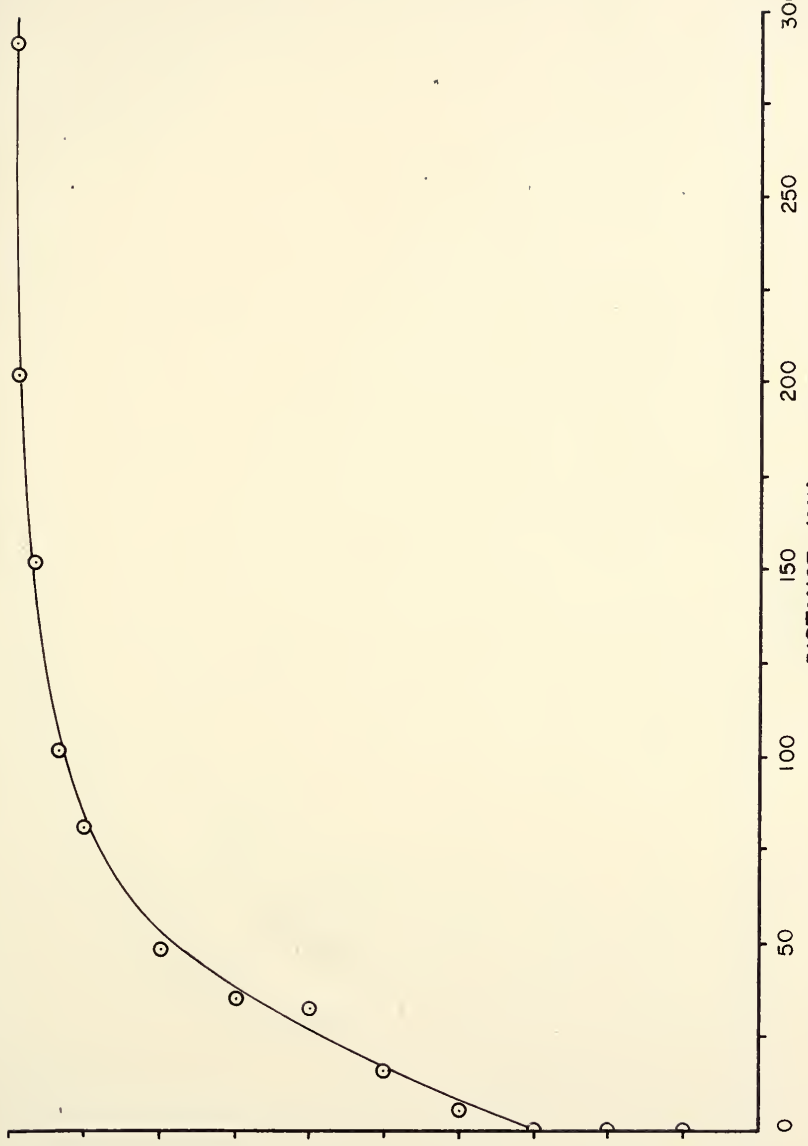


FIG. 12: RELATIONSHIP BETWEEN DISTANCE FROM MOUNDS AND CUMULATIVE PERCENTAGE OF TRIPS

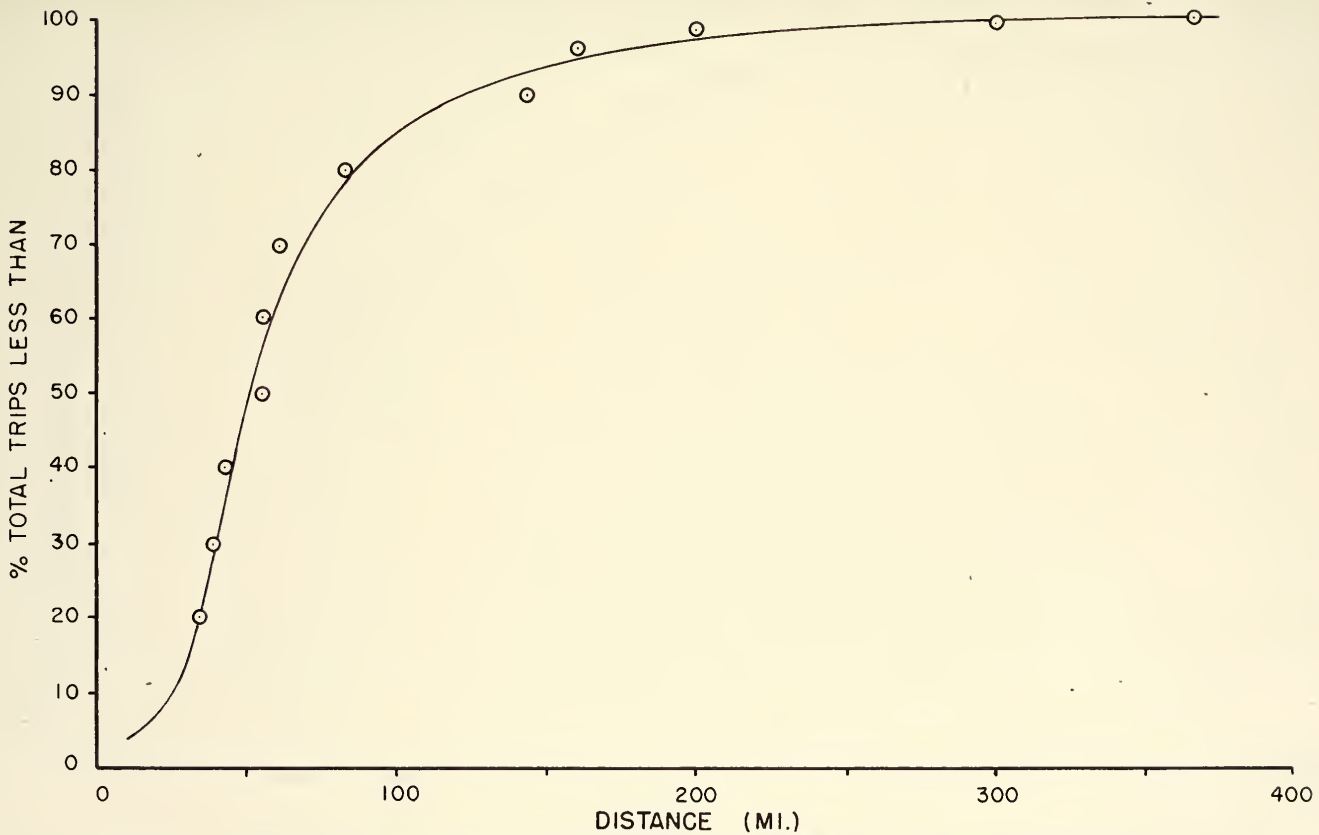


FIG. 13: RELATIONSHIP BETWEEN DISTANCE FROM SHADES AND CUMULATIVE PERCENTAGE OF TRIPS

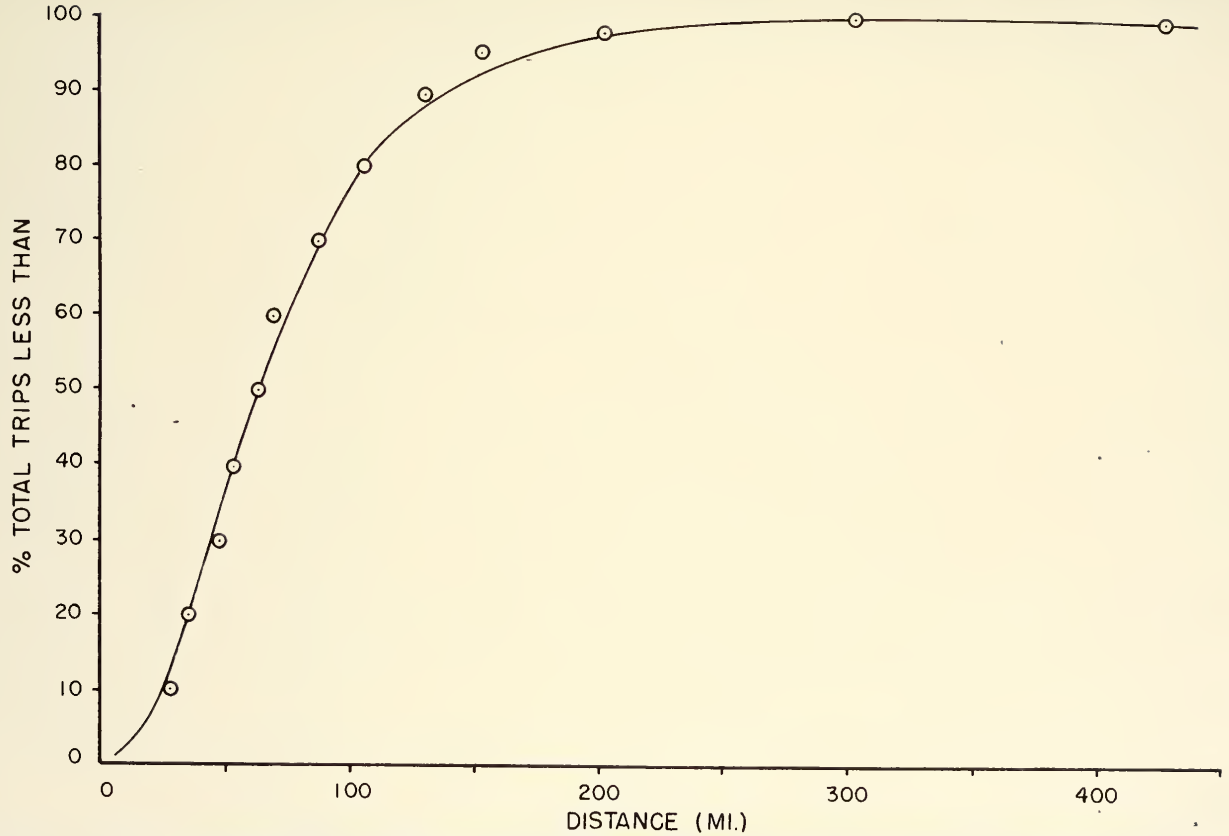


FIG. 14: RELATIONSHIP BETWEEN DISTANCE FROM TIPPECANOE RIVER AND CUMULATIVE PERCENTAGE OF TRIPS

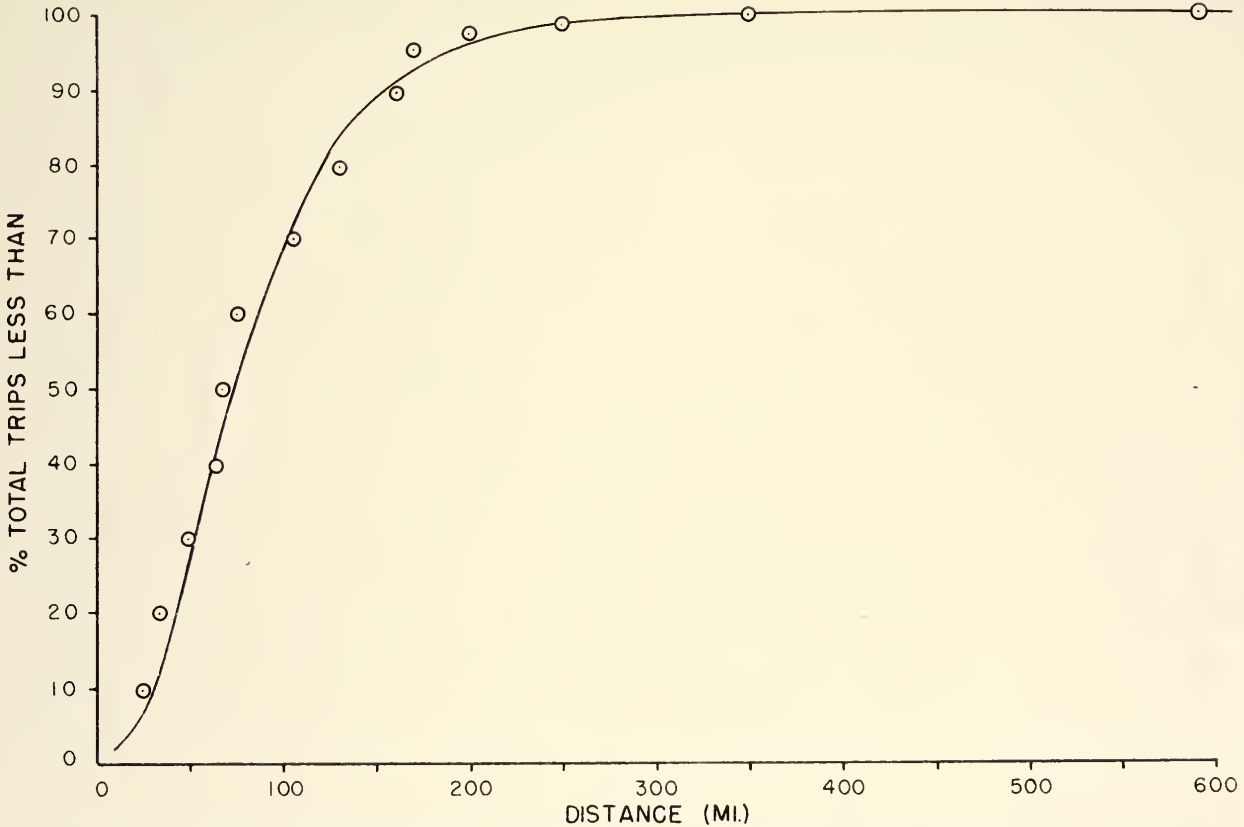


FIG. 15: RELATIONSHIP BETWEEN DISTANCE FROM TURKEY RUN AND CUMULATIVE PERCENTAGE OF TRIPS

Distribution of Arrivals

In the way of further analysis of the characteristics of recreational travel, a study was performed on the distribution of arrivals at the five state parks to determine the peak hours of arrival. These results are presented in Table 3 and Figures 16 through 21. The analysis was performed by hour, day, and park so that the peak hour could be determined for each of the parks on each of the three days of the weekend. The ratios are developed between hourly arrival and the total arrivals for that day. Figure 16, which shows average values of the five parks, indicates that the peak hour of arrival on Friday evening is between 7:00 - 8:00 PM, during which 23 percent of the total Friday evening arrivals occur, and that the peak hour of arrival on Sunday is between noon - 1:00 PM, during which 18 percent of the total Sunday arrivals occur. On Saturday, there does not seem to be one peak hour but an almost constant rate of arrival between the hours of 10:00 AM and 3:00 PM with a slight decrease at 1 o'clock. During this period 57 percent of the trips occurring on Saturday arrive.

In order to present a clearer picture of the daily distribution of arrivals during the weekend, Table 4 and Figure 22 are shown. In Figures 16 through 21 the arrivals during each hour were compared with the total arrivals for only that day and not the total arrivals for the weekend. This analysis shows the correct peaks for each day, but distorts the overall importance of that day when compared with the entire weekend. This was done to emphasize the peak hours on the individual day; however, Table 4 and Figure 22 remove this distortion, by comparing the arrivals during an hour to the total arrivals during the weekend. This figure indicates

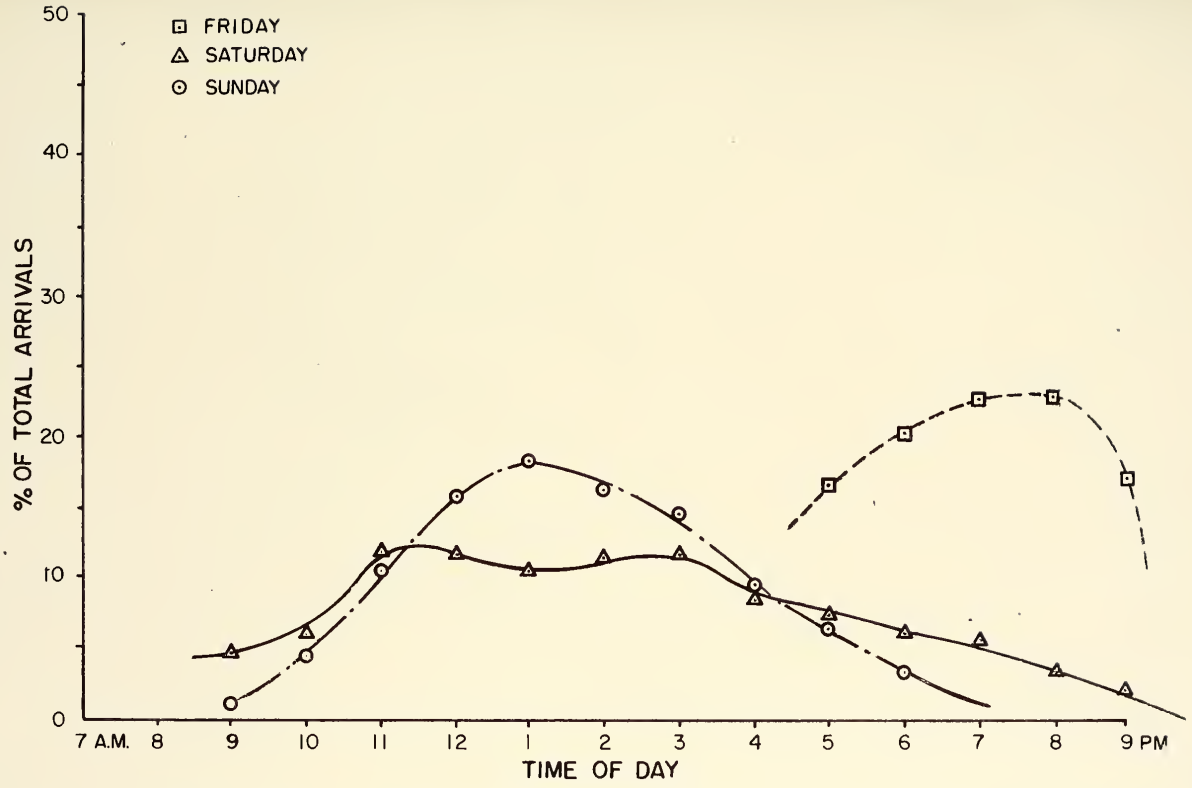


FIG. 16: PERCENTAGE OF DAILY ARRIVALS TO ALL STATE PARKS DISTRIBUTED BY TIME OF DAY

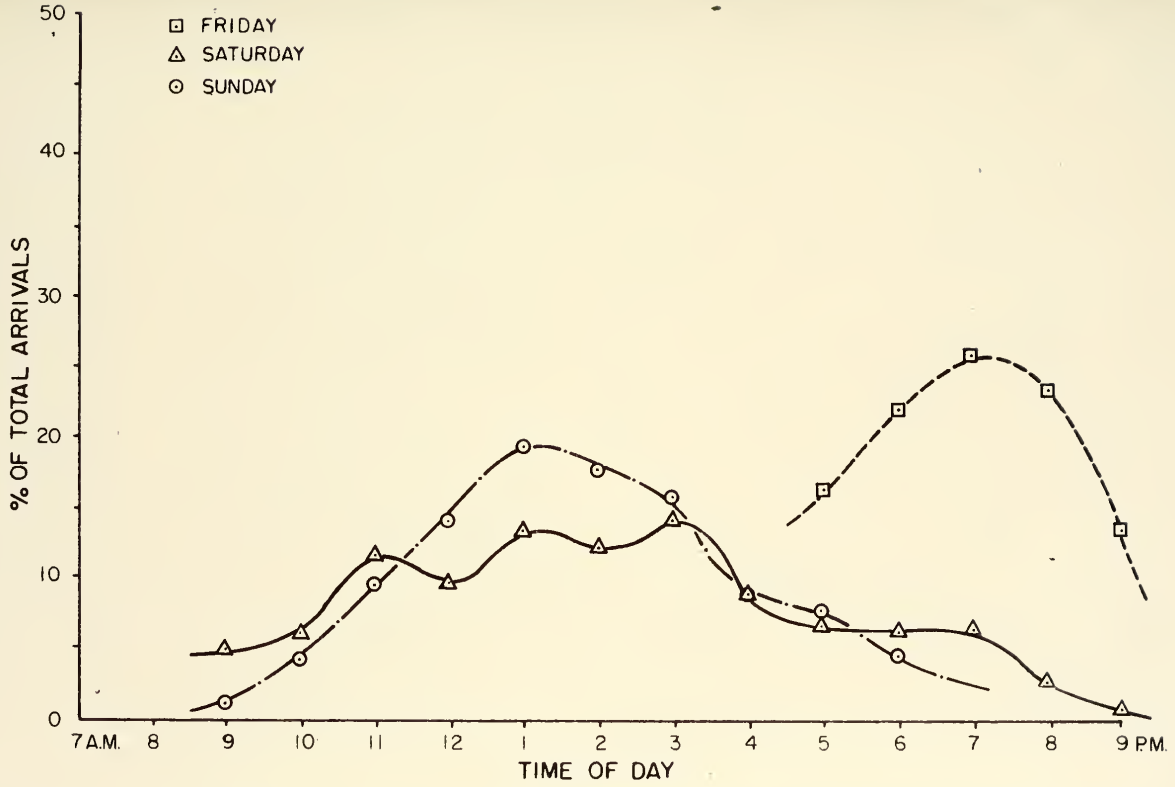


FIG. 17: PERCENTAGE OF DAILY ARRIVALS TO BROWN COUNTY STATE PARK DISTRIBUTED BY TIME OF DAY

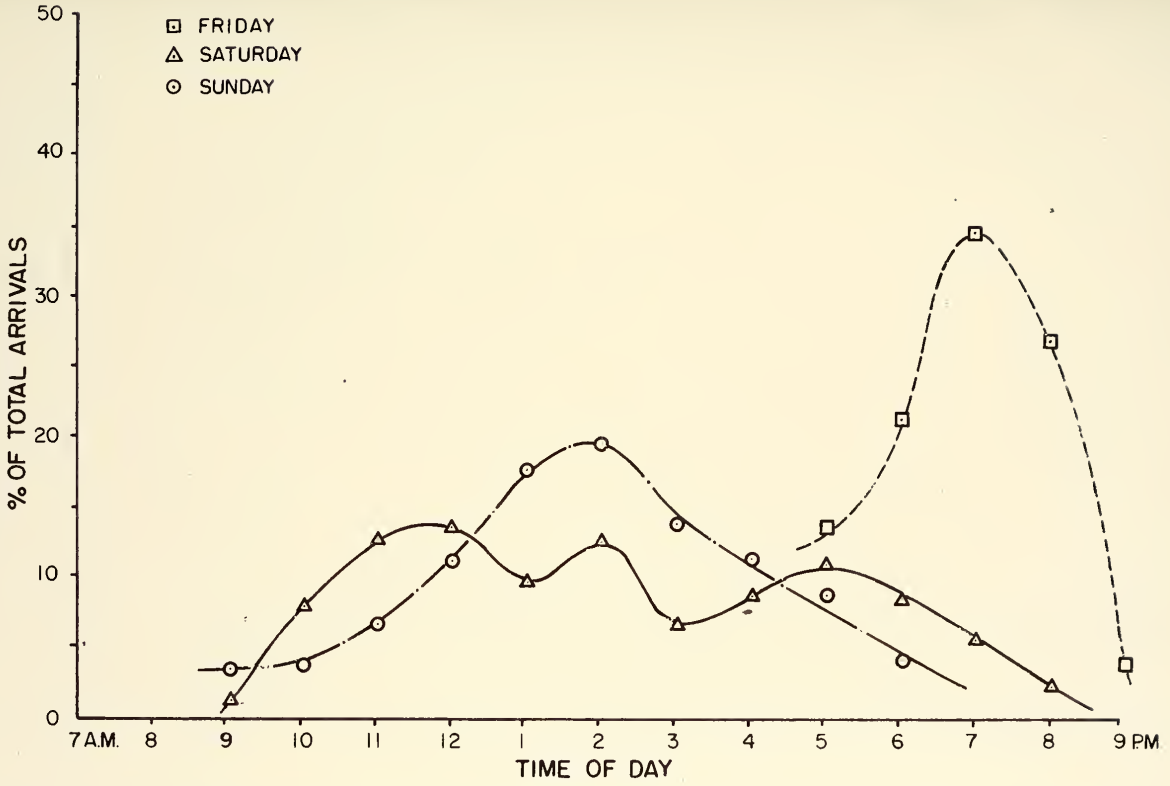


FIG. 18: PERCENTAGE OF DAILY ARRIVALS TO MOUNDS STATE PARK DISTRIBUTED BY TIME OF DAY

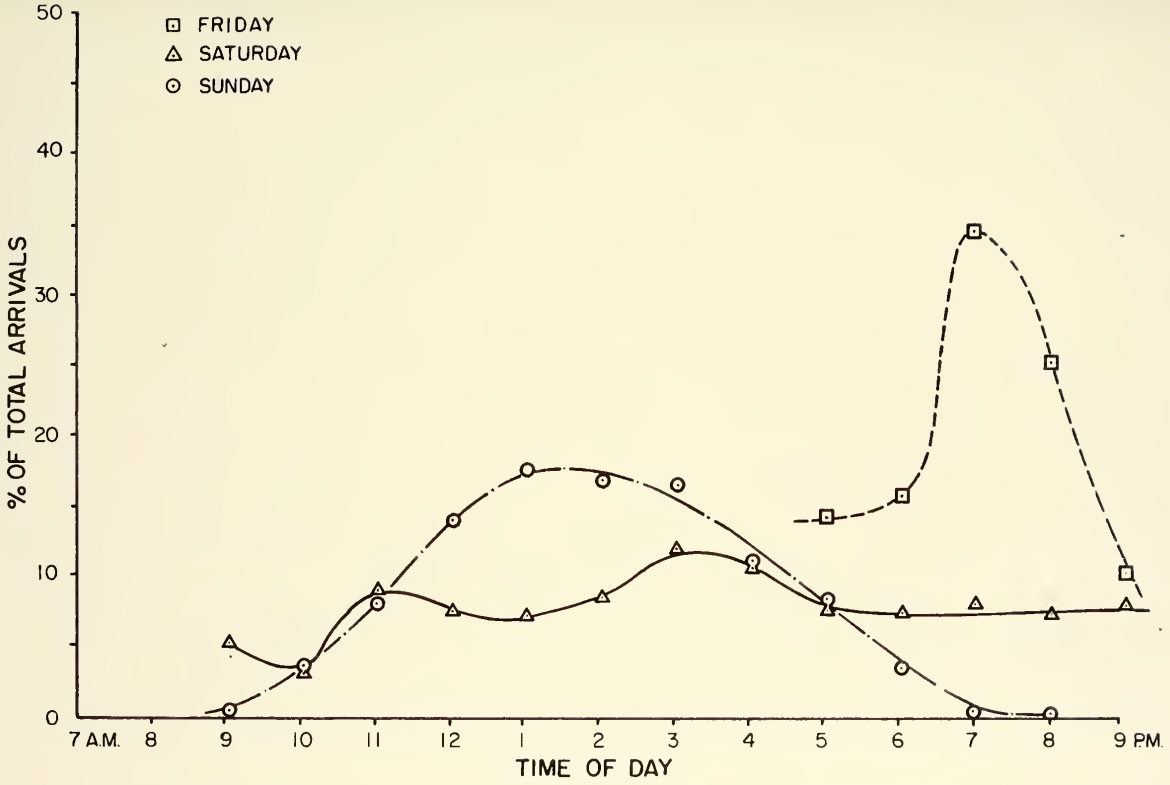


FIG. 19: PERCENTAGE OF DAILY ARRIVALS TO SHADES STATE PARK DISTRIBUTED BY TIME OF DAY

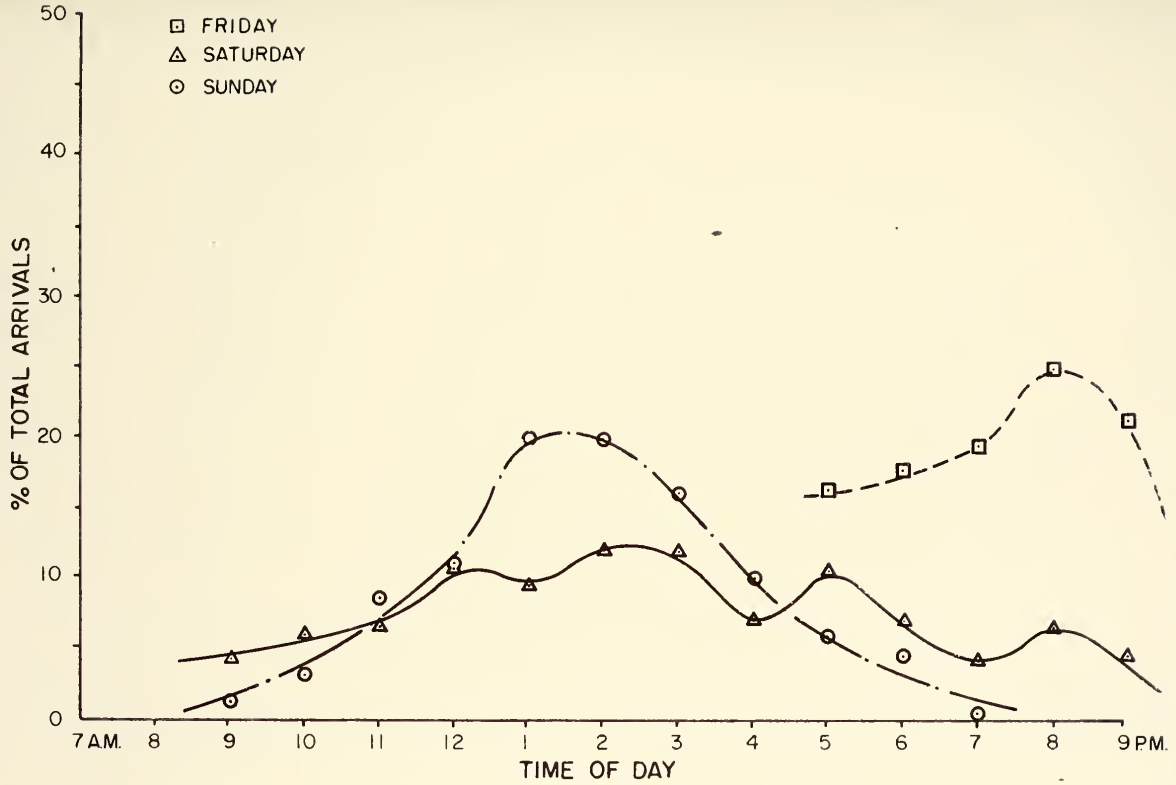


FIG. 20: PERCENTAGE OF DAILY ARRIVALS TO TIPPECANOE RIVER STATE PARK DISTRIBUTED BY TIME OF DAY

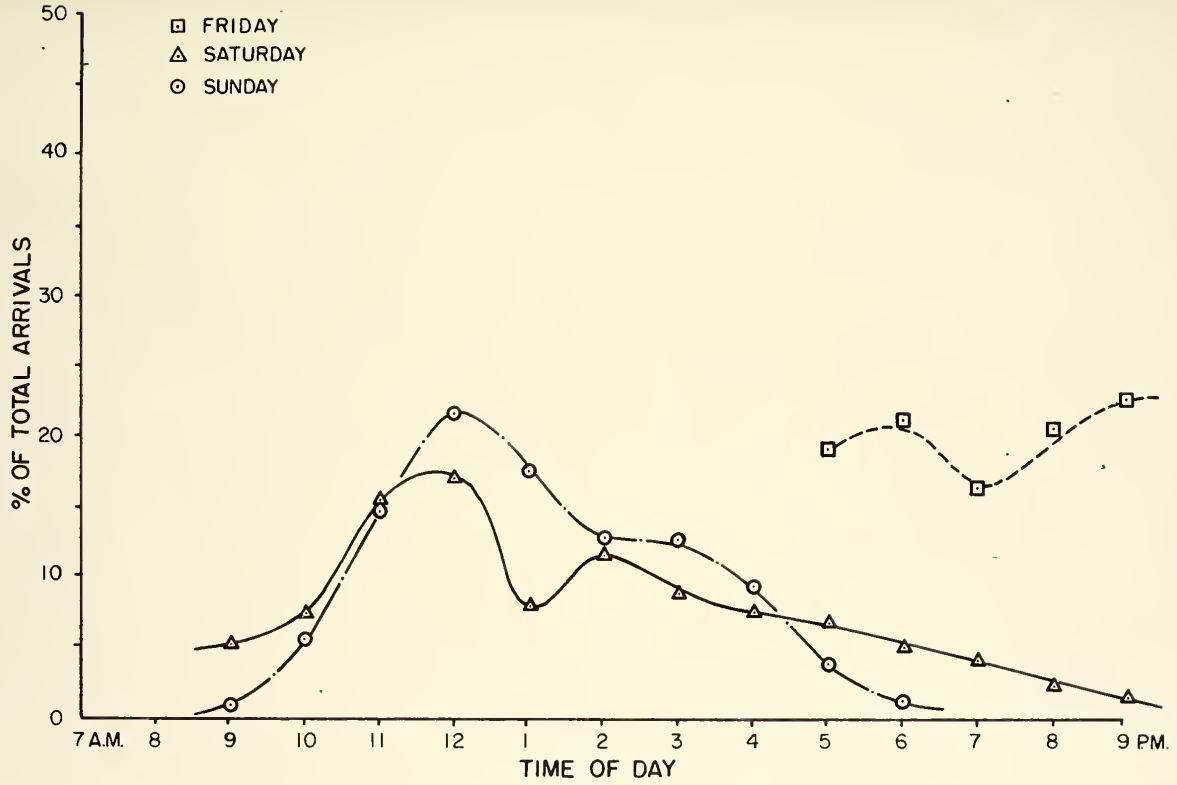


FIG. 21: PERCENTAGE OF DAILY ARRIVALS TO TURKEY RUN STATE PARK DISTRIBUTED BY TIME OF DAY

			TIME OF DAY												
			9	10	11	NOON	1	2	3	4	5	6	7	8	9
BROWN COUNTY	FRI.	TOTAL									73	99	116	106	60
		AVERAGE									14.6	19.8	23.2	21.2	12.0
		PERCENT									16.1	21.8	25.6	23.3	13.2
	SAT.	TOTAL	92	117	228	190	264	241	281	173	128	122	125	49	10
		AVERAGE	18.4	23.4	45.6	38.0	52.8	48.2	56.2	34.6	25.6	24.4	25.0	9.8	2.0
		PERCENT	4.6	5.8	11.3	9.4	13.1	11.9	13.9	8.6	6.3	6.0	6.2	2.4	0.5
	SUN.	TOTAL	47	208	476	712	984	901	801	442	375	222			
		AVERAGE	9.4	41.6	95.2	142.4	196.8	180.2	160.2	88.4	75.0	44.4			
		PERCENT	0.9	4.0	9.2	13.8	19.0	17.4	15.5	8.6	7.3	4.3			
MOUNDS	FRI.	TOTAL									7	11	18	14	2
		AVERAGE									1.4	2.2	3.6	2.8	0.4
		PERCENT									13.5	21.2	34.6	26.9	3.8
	SAT.	TOTAL	3	18	29	31	22	28	15	20	25	19	13	5	
		AVERAGE	0.6	3.6	5.8	6.2	4.4	5.6	3.0	4.0	5.0	3.8	2.6	1.0	
		PERCENT	1.3	7.9	12.7	13.6	9.6	12.3	6.6	8.8	11.0	8.3	5.7	2.2	
	SUN.	TOTAL	37	41	71	119	190	206	148	120	93	44			
		AVERAGE	7.4	8.2	14.2	23.8	38.0	41.2	29.6	24.0	18.6	8.8			
		PERCENT	3.5	3.8	6.7	11.1	17.8	19.3	13.8	11.2	8.7	4.1			

TABLE 3: PERCENT OF ARRIVALS TO ALL STATE PARKS DISTRIBUTED BY TIME OF DAY

			TIME OF DAY												
			9	10	11	NOON	1	2	3	4	5	6	7	8	9
SHADES	FRI.	TOTAL									18	20	44	32	13
		AVERAGE									3.6	4.0	8.8	6.4	2.6
		PERCENT									14.2	15.8	34.6	25.2	10.2
	SAT.	TOTAL	27	16	46	38	37	43	62	54	39	38	41	37	41
		AVERAGE	5.4	3.2	9.2	7.6	7.4	8.6	12.4	10.8	7.8	7.6	8.2	7.4	8.2
		PERCENT	5.2	3.1	8.9	7.3	7.1	8.3	12.0	10.4	7.5	7.3	7.9	7.1	7.9
	SUN.	TOTAL	4	42	99	174	218	210	205	137	102	46	6	5	1
		AVERAGE	0.8	8.4	19.8	34.8	43.6	42.0	41.0	27.4	20.4	9.2	1.2	1.0	0.2
		PERCENT	0.3	3.4	7.9	13.9	17.4	16.8	16.4	11.0	8.2	3.7	0.5	0.4	0.1
TIPPECANOE RIVER	FRI.	TOTAL									43	47	51	66	56
		AVERAGE									8.6	9.4	10.2	13.2	11.2
		PERCENT									16.3	17.9	19.4	25.1	21.3
	SAT.	TOTAL	20	28	30	49	44	56	56	33	50	33	20	31	21
		AVERAGE	4.0	5.6	6.0	9.8	8.8	11.2	11.2	6.6	10.0	6.6	4.0	6.2	4.2
		PERCENT	4.2	5.9	6.4	10.4	9.4	11.9	11.9	7.0	10.6	7.0	4.2	6.6	4.5
	SUN.	TOTAL	12	35	96	124	227	225	182	113	67	53	5		
		AVERAGE	2.4	7.0	19.2	24.8	45.4	45.0	36.4	22.6	13.4	10.6	1.0		
		PERCENT	1.1	3.1	8.4	10.9	19.9	19.8	16.0	9.9	5.9	4.6	0.4		

TABLE 3: PERCENT OF ARRIVALS TO ALL STATE PARKS DISTRIBUTED BY TIME OF DAY (CONTINUED)

			TIME OF DAY												
			9	10	11	NOON	1	2	3	4	5	6	7	8	9
TURKEY RUN	FRI.	TOTAL									72	80	62	78	86
		AVERAGE									14.4	16.0	12.4	15.6	17.2
		PERCENT									19.0	21.2	16.4	20.6	22.8
	SAT.	TOTAL	67	94	199	219	102	148	114	95	88	64	52	29	18
		AVERAGE	13.4	18.8	39.8	43.8	20.4	29.6	22.8	19.0	17.6	12.8	10.4	5.8	3.6
		PERCENT	5.2	7.3	15.4	17.0	7.9	11.5	8.8	7.4	6.8	5.0	4.0	2.3	1.4
	SUN.	TOTAL	37	226	595	883	710	516	513	375	159	46	7	5	3
		AVERAGE	7.4	45.2	119.0	176.6	142.0	103.2	102.6	75.0	31.8	9.2	1.4	1.0	0.6
		PERCENT	0.9	5.5	14.6	21.7	17.4	12.7	12.6	9.2	3.9	1.1	0.2	0.1	0.1
ALL PARKS	FRI.	TOTAL									213	257	291	296	217
		AVERAGE									42.6	51.4	58.2	59.2	43.4
		PERCENT									16.7	20.2	22.9	23.2	17.0
	SAT.	TOTAL	209	273	532	527	469	516	528	375	330	276	251	151	90
		AVERAGE	41.8	54.6	106.4	105.4	93.8	103.2	105.6	75.0	66.0	55.2	50.2	30.2	18.0
		PERCENT	4.6	6.0	11.8	11.6	10.4	11.4	11.7	8.3	7.3	6.1	5.5	3.3	2.0
	SUN.	TOTAL	137	552	1337	2012	2329	2058	1849	1187	796	411	18	10	4
		AVERAGE	27.4	110.4	267.4	402.4	465.8	411.6	369.8	237.4	159.2	82.2	3.6	2.0	0.8
		PERCENT	1.0	4.4	10.5	15.8	18.3	16.2	14.6	9.4	6.3	3.3	0.1	0.1	0.0

TABLE 3: PERCENT OF ARRIVALS TO ALL STATE PARKS DISTRIBUTED BY TIME OF DAY (CONCLUDED)

			TIME OF DAY												
			9	10	11	NOON	1	2	3	4	5	6	7	8	9
BROWN COUNTY	FRI.	TOTAL									73	99	116	106	60
		AVERAGE									14.6	19.8	23.2	21.2	12.0
		PERCENT									16.1	21.8	25.6	23.3	13.2
	SAT.	TOTAL	92	117	228	190	264	241	281	173	128	122	125	49	10
		AVERAGE	18.4	23.4	45.6	38.0	52.8	48.2	56.2	34.6	25.6	24.4	25.0	9.8	2.0
		PERCENT	4.6	5.8	11.3	9.4	13.1	11.9	13.9	8.6	6.3	6.0	6.2	2.4	0.5
	SUN.	TOTAL	47	208	476	712	984	901	801	442	375	222			
		AVERAGE	9.4	41.6	95.2	142.4	196.8	180.2	160.2	88.4	75.0	44.4			
		PERCENT	0.9	4.0	9.2	13.8	19.0	17.4	15.5	8.6	7.3	4.3			
MOUNDS	FRI.	TOTAL									7	11	18	14	2
		AVERAGE									1.4	2.2	3.6	2.8	0.4
		PERCENT									13.5	21.2	34.6	26.9	3.8
	SAT.	TOTAL	3	18	29	31	22	28	15	20	25	19	13	5	
		AVERAGE	0.6	3.6	5.8	6.2	4.4	5.6	3.0	4.0	5.0	3.8	2.6	1.0	
		PERCENT	1.3	7.9	12.7	13.6	9.6	12.3	6.6	8.8	11.0	8.3	5.7	2.2	
	SUN.	TOTAL	37	41	71	119	190	206	148	120	93	44			
		AVERAGE	7.4	8.2	14.2	23.8	38.0	41.2	29.6	24.0	18.6	8.8			
		PERCENT	3.5	3.8	6.7	11.1	17.8	19.3	13.8	11.2	8.7	4.1			

TABLE 3: PERCENT OF ARRIVALS TO ALL STATE PARKS DISTRIBUTED BY TIME OF DAY

TIME OF DAY	FRIDAY	SATURDAY	SUNDAY
8—9		1.13	0.74
9—10		1.47	2.98
10—11		2.87	7.22
11—12		2.85	10.86
12—1		2.53	12.57
1—2		2.79	11.11
2—3		2.85	9.98
3—4		2.03	6.41
4—5	1.15	1.78	4.30
5—6	1.38	1.49	2.22
6—7	1.57	1.36	0.09
7—8	1.59	0.82	0.05
8—9	1.17	0.49	0.02

TABLE 4: HOURLY DISTRIBUTION BY PERCENT OF TOTAL WEEKEND TRIPS TO ALL STATE PARKS

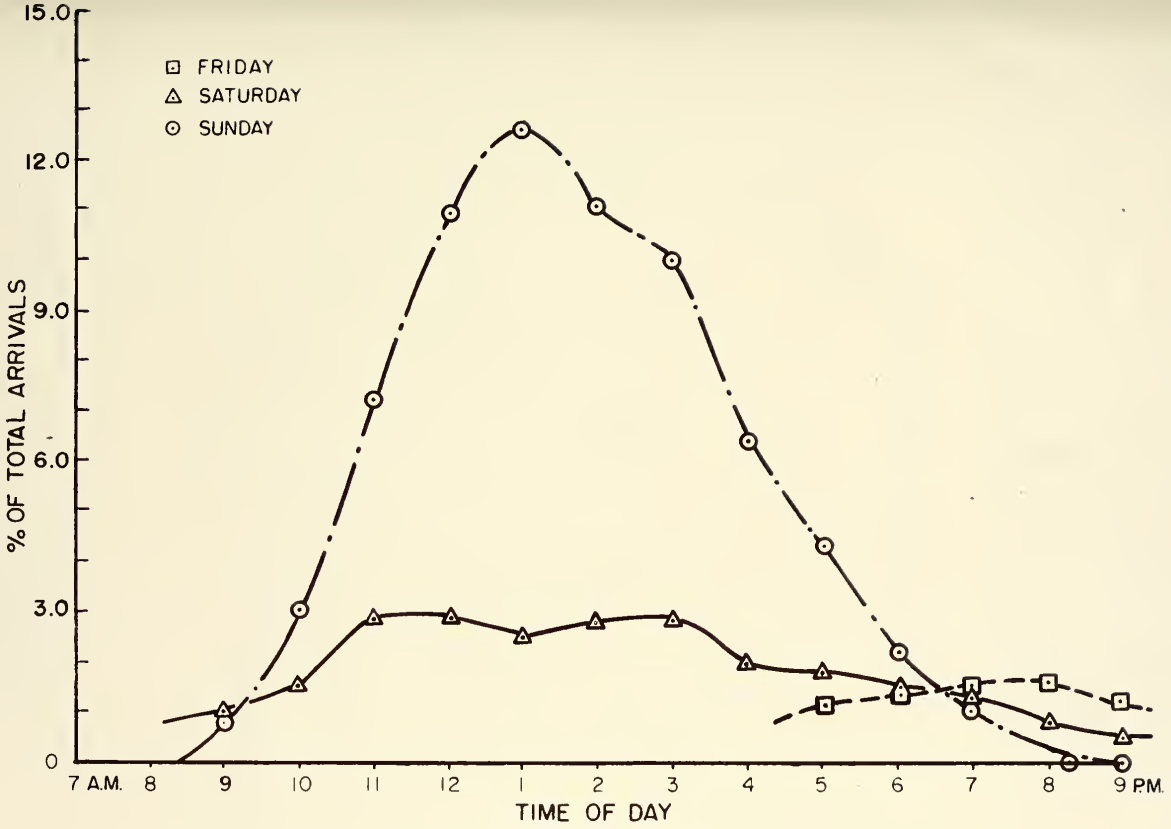


FIG. 22: PERCENTAGE OF TOTAL ARRIVALS TO ALL STATE PARKS DISTRIBUTED BY TIME OF DAY

that 1.6 percent of the total weekend trips occur during the Friday peak hour, 14.9 percent of the total trips occur during the Saturday 11:00 AM - 3:00 PM peak period and 12.6 percent of the total trips occur during the Sunday peak hour. It also points out the predominance of Sunday arrivals; nearly 70 percent of the total trips to the park are made on Sunday.

Percent of Trips Occurring on the Weekend

Using the information in the "Weekly Activity Reports," it was possible to calculate the percent of the total arrivals in a week which occur on the weekend for each of the parks. This information was available for the period beginning with the week ending June 2 and concluding with week ending August 25 and is presented in Table 5. Since the percent desired was that for an average weekend, the weekends ending June 2, and July 7 were eliminated because of the Memorial Day and Fourth of July holidays. These holidays occurred during the week and therefore caused an observable decrease in the percent of trips occurring on the weekend for these two weeks, and as a result, a large standard deviation. Eliminating these two weekends, the results of the study indicate that the mean percentage of trips occurring on a weekend is 66.4 percent with a standard deviation on the mean of .7, or there is 95 percent confidence, that the mean value lies between 64.9 and 67.9 percent.

WEEK ENDING	Bass Lake			Brown County			Clifty Falls			Indiana Dunes		
	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT
6-2	321	469	68.4	1499	4105	36.5	699	1576	44.4	3351	6183	54.2
6-9	698	849	82.2	1803	2528	71.3	605	806	75.1	3538	4797	73.8
6-16	397	458	86.7	1622	2469	65.7	742	1067	69.5	2514	3628	69.3
6-23	541	729	74.2	2087	2960	70.5	769	1094	70.3	2765	4150	66.6
6-30	1069	1504	71.1	2054	3283	62.6	796	1280	62.2	4338	6802	63.8
7-7	543	1231	44.1	1251	4121	30.4	668	1700	39.3	2849	7217	39.5
7-14	268	516	51.9	1417	2595	54.6	760	1256	60.5	2413	4360	55.3
7-21	484	776	62.4	1733	2932	59.1	929	1319	70.4	3865	6409	60.3
7-28	596	934	63.8	1655	3084	53.7	821	1249	65.7	4048	6842	59.2
8-4	571	811	70.4	1960	3199	61.3	872	1281	68.1	4139	6776	61.1
8-11	602	800	75.2	2018	3461	58.3	1003	1470	68.2	3763	6183	60.9
8-18	120	225	53.3	1824	3062	59.6	1111	1581	70:3	2429	4424	54.9
8-25	266	519	51.3	1447	2705	53.5	891	1335	66.7	2310	4854	47.6

TABLE 5: PERCENTAGE OF TOTAL TRIPS OCCURING ON THE WEEKEND

WEEK ENDING	Lieber			Lincoln			McCormick's Creek			Mounds		
	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT
6-2	1023	1830	55.9	491	1132	43.4	671	1809	37.1	434	1412	30.7
6-9	1931	2355	82.0	832	1093	76.1	983	1508	65.2	342	460	74.3
6-16	1113	1345	82.8	555	837	66.3	829	1463	56.7	300	353	85.0
6-23	1797	2148	83.7	873	1177	74.2	1066	1699	62.7	386	517	74.7
6-30	1917	2515	76.2	914	1303	70.1	907	1808	50.2	315	512	61.5
7-7	1101	3452	31.9	717	2002	35.8	567	2181	26.0	193	926	20.8
7-14	990	1533	64.6	703	1186	59.3	754	1460	51.6	218	367	59.4
7-21	1696	2374	71.4	844	1346	62.7	952	1774	53.7	603	738	81.7
7-28	1447	2074	69.8	550	966	56.9	931	1906	48.8	296	420	70.5
8-4	1623	2162	75.1	834	1208	69.0	911	1653	55.1	300	426	70.4
8-11	1510	2142	70.5	801	1242	64.5	1001	1738	57.6	311	422	73.7
8-18	865	1201	72.0	580	922	62.9	877	1691	51.9	242	367	65.9
8-25	755	1147	65.8	456	801	56.9	726	1424	51.0	248	351	70.7

TABLE 5: PERCENTAGE OF TOTAL TRIPS OCCURING ON THE WEEKEND
(CONTINUED)

WEEK ENDING	Pokagon			Raccoon Lake			Scales Lake			Shades		
	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT
6-2	1372	2796	49.1	1267	2095	60.5	214	405	52.8	461	888	51.9
6-9	1789	2283	78.4	1951	2263	86.2	298	437	68.2	332	396	83.8
6-16	1366	1748	78.1	1511	1792	84.3	107	279	38.4	363	432	84.0
6-23	1902	2517	75.6	1872	2298	81.5	220	347	63.4	351	425	82.6
6-30	2383	3359	70.9	2373	3136	75.7	252	497	50.7	382	492	77.6
7-7	1821	3896	46.7	1315	3474	37.9	157	524	30.0	304	661	46.0
7-14	1518	2483	61.1	1296	1925	67.3	193	350	55.1	315	455	69.2
7-21	1974	2885	68.4	2101	2949	71.2	234	420	55.7	467	574	81.4
7-28	2084	3092	67.4	1859	2612	71.2	134	315	42.5	433	557	77.7
8-4	1906	2854	66.8	2115	2840	74.5	263	407	64.6	445	552	80.6
8-11	1961	3067	63.9	1975	2610	75.7	191	345	55.4	421	536	78.5
8-18	1300	2226	58.4	1077	1585	67.9	100	209	47.8	397	511	77.7
8-25	1303	2249	57.9	965	1454	66.4	148	312	47.4	281	386	72.8

TABLE 5: PERCENTAGE OF TOTAL TRIPS OCCURING ON THE WEEKEND
(CONTINUED)

WEEK ENDING	Shakamak			Spring Mill			Tippecanoe River			Turkey Run		
	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT
6-2	753	1533	49.1	1036	2382	43.5	350	679	51.5	1136	2831	40.1
6-9	1207	1731	69.7	1320	1783	74.0	270	344	78.5	1084	1636	66.3
6-16	971	1417	68.5	1263	1824	69.2	301	375	80.3	1166	1660	70.2
6-23	986	1500	65.7	1360	1968	69.1	362	478	75.7	1402	2024	69.3
6-30	1133	2009	56.4	1482	2346	63.2	377	569	66.3	1159	1742	66.5
7-7	880	2329	37.8	1749	3253	53.8	329	698	47.1	860	2260	38.1
7-14	835	1545	54.0	1304	2249	58.0	413	581	71.1	1364	2256	60.5
7-21	1164	1968	59.1	1658	2686	61.7	393	527	74.6	1245	1951	63.8
7-28	760	1365	55.7	1521	2522	60.3	355	502	70.7	1531	2314	66.2
8-4	887	1406	63.1	1646	2522	65.3	393	515	76.3	1146	1827	62.7
8-11	878	1632	53.8	1581	2677	59.1	386	500	77.2	1282	1996	64.2
8-18	667	1083	61.6	1504	2460	61.1	280	396	70.7	1324	2126	62.3
8-25	741	1211	61.2	1372	2341	58.6	332	495	67.1	1264	2044	61.8

TABLE 5: PERCENTAGE OF TOTAL TRIPS OCCURING ON THE WEEKEND
(CONTINUED)

WEEK ENDING	Versailles			Whitewater								
	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT	WEEKEND	TOTAL	PERCENT
6-2	1006	1988	50.6	1552	2809	55.3						
6-9	1477	1704	86.7	2463	2690	91.6						
6-16	1168	1540	75.8	1731	2163	80.0						
6-23	1378	1855	74.3	2142	2821	75.9						
6-30	1600	2399	66.7	2143	3419	62.7						
7-7	802	2677	30.0	1490	4114	36.2						
7-14	1089	1823	59.7	1075	1817	59.2						
7-21	1505	2288	65.8	1740	2883	60.4						
7-28	1313	2079	63.2	1838	2834	64.9						
8-4	1709	2542	67.2	2018	2860	70.6						
8-11	1325	2159	61.4	1621	2365	68.5						
8-18	1030	1519	67.8	775	1160	66.8						
8-25	701	1067	65.7	666	967	68.9						

TABLE 5: PERCENTAGE OF TOTAL TRIPS OCCURING ON THE WEEKEND
(CONCLUDED)

DISCUSSION OF RESULTS

Following the procedure described in the previous chapters, the gravity model constants were determined. The resultant model stated in its suggested computational form is

$$T_{ij} = T_i \cdot \frac{\frac{R_j}{(D_{ij})^{1.64}}}{\sum_{j=1}^{n} \frac{R_j}{(D_{ij})^{1.64}}}$$

where all the terms are as previously defined.

Having obtained the gravity model, a second Fortran IV program was written to compare the distribution using the model with the distribution observed in the field. This program was designed to:

(1) compute the number of trips from each of the counties to the park

(2) find the average number of trips per weekend for each of the counties

(3) find the difference between the observed and calculated number of trips for each observation

(4) compute the root-mean-square error and the percent root-mean-square errors.

Tables 6 through 9 show the comparison between the observed and calculated trips for each of the parks and Table 10 shows the resulting root-mean-square errors (RMS error) and the percent root-mean-square errors (percent RMS error).

TABLE 6: COMPARISON OF OBSERVED AND CALCULATED TRIPS

BROWN COUNTY

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
1	2	1	1	32	16	9	7
2	10	8	2	33	12	5	7
3	202	73	129	34	9	5	4
4	2	1	1	35	2	2	0
5	2	1	1	36	27	14	13
6	9	4	5	37	2	1	1
7	45	401	-356	38	3	1	2
8	1	1	0	39	5	4	1
9	3	2	1	40	6	6	0
10	7	6	1	41	86	26	60
11	4	5	-1	42	6	5	1
12	2	3	-1	43	2	2	0
13	1	1	0	44	1	1	0
14	3	3	0	45	20	12	8
15	6	3	3	46	4	3	1
16	14	6	8	47	11	13	-2
17	1	1	0	48	20	13	7
18	12	8	4	49	412	172	240
19	2	2	0	50	2	1	1
20	4	3	1	51	2	2	0
21	4	3	1	52	3	2	1
22	8	5	3	53	128	87	41
23	1	1	0	54	4	4	0
24	2	2	0	55	37	25	12
25	1	1	0	56	1	1	0
26	3	2	1	57	2	1	1
27	7	5	2	58	3	0	3
28	5	11	-6	59	2	3	-1
29	15	6	9	60	3	6	-3
30	11	4	7	61	1	2	-1
31	2	2	0	62	2	1	1

TABLE 6: COMPARISON OF OBSERVED AND CALCULATED TRIPS

BROWN COUNTY (CONTINUED)

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
63	1	1	0	94	1	4	-3
64	2	2	0	95	1	2	-1
65	2	1	1	96	1	3	-2
66	1	1	0	97	19	100	-81
67	3	4	-1	98	1	2	-1
68	2	2	0	99	1	1	0
69	3	4	-1	100	1	1	0
70	5	3	2	101	3	5	-2
71	7	6	1	102	2	2	0
72	2	3	-1	103	2	1	1
73	27	10	17	104	1	0	1
74	1	1	0	105	1	0	1
75	1	1	0	106	1	1	0
76	1	1	0	107	1	1	0
77	1	4	-3	108	1	1	0
78	1	1	0	109	2	3	-1
79	12	6	6	110	1	2	-1
80	2	2	0	111	1	4	-3
81	1	1	0	112	1	2	-1
82	5	9	-4	113	1	1	0
83	1	1	0	114	1	1	0
84	11	14	-3	115	1	1	0
85	2	2	0	116	2	2	0
86	1	1	0	117	2	4	-2
87	2	1	1	118	1	5	-4
88	3	4	-1	119	1	2	-1
89	6	5	1	120	1	0	1
90	1	1	0	121	1	0	1
91	3	1	2	122	1	1	0
92	2	1	1	123	1	1	0
93	1	0	1	124	1	1	0

TABLE 6: COMPARISON OF OBSERVED AND CALCULATED TRIPS
BROWN COUNTY (CONTINUED)

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
125	1	4	-3	156	1	1	0
126	1	1	0	157	1	1	0
127	1	2	-1	158	1	1	0
128	1	3	-2	159	1	1	0
129	1	2	-1	160	1	2	-1
130	2	6	-4	161	2	7	-5
131	1	1	0	162	1	2	-1
132	1	0	1	163	2	1	1
133	1	0	1	164	1	1	0
134	1	1	0	165	1	1	0
135	1	3	-2	166	2	3	-1
136	1	2	-1	167	22	22	0
137	1	1	0	168	1	0	1
138	2	3	-1	169	1	0	1
139	1	1	0	170	2	2	0
140	1	1	0	171	1	2	-1
141	11	13	-2	172	1	1	0
142	3	4	-1	173	1	3	-2
143	3	3	0	174	1	5	-4
144	1	1	0	175	1	2	-1
145	1	1	0	176	1	1	0
146	1	16	-15	177	1	1	0
147	2	2	0	178	1	1	0
148	1	1	0	179	1	0	1
149	4	15	-11	180	3	3	0
150	1	1	0	181	1	1	0
151	1	3	-2	182	3	1	2
152	1	1	0	183	1	1	0
153	42	57	-15	184	1	1	0
154	1	1	0	185	3	5	-2
155	1	1	0	186	1	3	-2

TABLE 6: COMPARISON OF OBSERVED AND CALCULATED TRIPS
BROWN COUNTY (CONCLUDED)

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
187	1	0	1	206	1	1	0
188	2	5	-3	207	1	3	-2
189	1	2	-1	208	1	2	-1
190	1	0	1	209	1	4	-3
191	1	2	-1	210	1	0	1
192	1	0	1	211	1	2	-1
193	1	1	0	212	1	7	-6
194	1	1	0	213	1	2	-1
195	30	53	-23	214	2	30	-28
196	1	0	1	215	1	1	0
197	3	8	-5	216	1	0	1
198	1	0	1	217	1	11	-10
199	1	1	0	218	1	0	1
200	1	1	0	219	1	1	0
201	1	0	1	220	1	0	1
202	1	1	0	221	2	12	-10
203	1	0	1				
204	1	4	-3	Totals	1617	1634	
205	1	0	1				

TABLE 7: COMPARISON OF OBSERVED AND CALCULATED TRIPS

SHADES

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
1	1	0	1	32	1	1	0
2	6	4	2	33	1	1	0
3	1	2	-1	34	1	1	0
4	2	1	1	35	1	0	1
5	1	0	1	36	3	2	1
6	14	5	9	37	1	1	0
7	1	0	1	38	1	1	0
8	3	2	1	39	1	0	1
9	1	2	-1	40	6	11	-5
10	1	1	0	41	2	2	0
11	3	3	0	42	1	1	0
12	6	4	2	43	9	6	3
13	1	1	0	44	80	58	22
14	1	0	1	45	1	1	0
15	1	1	0	46	1	0	1
16	1	0	1	47	1	1	0
17	3	2	1	48	3	2	1
18	2	2	0	49	41	32	9
19	18	5	13	50	2	2	0
20	1	0	1	51	2	1	1
21	1	1	0	52	1	1	0
22	1	1	0	53	5	5	0
23	1	2	-1	54	1	0	1
24	1	1	0	55	2	1	1
25	8	3	5	56	1	1	0
26	2	1	1	57	5	3	2
27	1	0	1	58	1	0	1
28	13	5	8	59	1	1	0
29	2	2	0	60	4	4	0
30	5	3	2	61	2	1	1
31	1	1	0	62	1	0	1

TABLE 7: COMPARISON OF OBSERVED AND CALCULATED TRIPS

SHADES (CONTINUED)

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
63	1	1	0	94	1	2	-1
64	1	1	0	95	1	2	-1
65	1	0	1	96	1	3	-2
66	30	12	18	97	1	2	-1
67	1	1	0	98	1	3	-2
68	1	0	1	99	1	1	0
69	1	2	-1	100	1	0	1
70	8	3	5	101	1	1	0
71	10	11	-1	102	1	1	0
72	1	1	0	103	1	2	-1
73	2	0	2	104	1	1	0
74	1	0	1	105	1	2	-1
75	1	2	-1	106	20	14	6
76	1	0	1	107	1	3	-2
77	2	2	0	108	1	2	-1
78	1	0	1	109	1	1	0
79	1	0	1	110	1	6	-5
80	1	0	1	111	1	6	-5
81	9	6	3	112	1	1	0
82	1	1	0	113	1	13	-12
83	1	2	-1	114	1	0	1
84	7	82	-75	115	1	0	1
85	1	1	0	116	1	1	0
86	1	0	1	117	1	7	-6
87	1	0	1	118	1	1	0
88	1	1	0	119	1	1	0
89	2	4	-2	120	1	1	0
90	2	2	0	121	1	2	-1
91	1	1	0	122	1	1	0
92	1	1	0	123	1	1	0
93	2	1	1	124	1	1	0

TABLE 7: COMPARISON OF OBSERVED AND CALCULATED TRIPS

SHADES (CONCLUDED)

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
125	1	1	0				
126	1	12	-11				
127	1	1	0				
128	1	7	-6				
129	1	0	1				
130	1	1	0				
131	1	1	0				
132	1	6	-5				
Totals	440	445					

TABLE 8: COMPARISON OF OBSERVED AND CALCULATED TRIPS

TIPPECANOE RIVER

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
1	1	0	1	32	53	24	29
2	13	6	7	33	22	12	10
3	2	1	1	34	1	0	1
4	1	0	1	35	5	3	2
5	1	0	1	36	18	15	3
6	2	1	1	37	18	6	12
7	3	2	1	38	5	3	2
8	15	7	8	39	1	1	0
9	1	0	1	40	1	1	0
10	4	2	2	41	1	1	0
11	2	1	1	42	2	1	1
12	3	2	1	43	5	1	4
13	26	5	21	44	1	0	1
14	1	0	1	45	1	0	1
15	1	0	1	46	1	0	1
16	14	4	10	47	8	5	3
17	4	3	1	48	15	34	-19
18	2	0	2	49	1	0	1
19	2	1	1	50	14	17	-3
20	1	1	0	51	1	1	0
21	1	0	1	52	8	20	-12
22	2	1	1	53	1	0	1
23	1	1	0	54	5	4	1
24	19	5	14	55	1	1	0
25	2	1	1	56	1	1	0
26	2	2	0	57	1	2	-1
27	1	1	0	58	2	2	0
28	1	0	1	59	1	1	0
29	1	1	0	60	4	3	1
30	9	4	5	61	4	1	3
31	1	0	1	62	1	0	1

TABLE 8: COMPARISON OF OBSERVED AND CALCULATED TRIPS
.TIPPECANOE RIVER(CONCLUDED)

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
63	1	1	0	94	1	2	-1
64	35	118	-83	95	1	1	0
65	1	0	1	96	1	6	-5
66	2	5	-3	97	1	1	0
67	1	0	1	98	1	4	-3
68	1	1	0	99	1	0	1
69	1	3	-2	100	1	5	-4
70	2	2	0	101	1	0	1
71	1	4	-3	102	1	0	1
72	1	2	-1	103	1	2	-1
73	1	1	0	104	1	0	1
74	1	1	0	105	1	0	1
75	1	1	0	106	1	1	0
76	1	0	1	107	1	1	0
77	1	0	1	108	1	7	-6
78	1	1	0	109	1	2	-1
79	1	1	0	110	1	2	-1
80	1	1	0	111	1	2	-1
81	1	2	-1	112	1	3	-2
82	3	4	-1	113	1	4	-3
83	1	0	1	114	1	2	-1
84	1	2	-1	115	1	1	0
85	1	3	-2	116	1	1	0
86	1	0	1	117	1	13	-12
87	1	1	0				
88	1	8	-7	Totals	435	437	
89	1	1	0				
90	1	0	1				
91	1	1	0				
92	1	1	0				
93	1	0	1				

TABLE 9: COMPARISON OF OBSERVED AND CALCULATED TRIPS

TURKEY RUN

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
1	3	1	2	32	15	6	9
2	8	8	0	33	5	2	3
3	3	3	0	34	1	2	-1
4	9	2	7	35	3	2	1
5	2	1	1	36	3	1	2
6	24	8	16	37	1	1	0
7	1	1	0	38	1	1	0
8	6	3	3	39	7	4	3
9	5	4	1	40	6	4	2
10	1	2	-1	41	4	3	1
11	13	13	0	42	1	1	0
12	16	6	10	43	51	27	24
13	2	2	0	44	8	4	4
14	1	1	0	45	2	3	-1
15	1	1	0	46	26	11	15
16	1	1	0	47	145	102	43
17	9	7	2	48	5	2	3
18	1	1	0	49	1	1	0
19	4	4	0	50	3	3	0
20	1	1	0	51	4	6	-2
21	1	2	-1	52	41	27	14
22	27	16	11	53	9	4	5
23	3	1	2	54	5	2	3
24	4	2	2	55	2	1	1
25	9	5	4	56	1	0	1
26	4	3	1	57	1	1	0
27	16	5	11	58	3	2	1
28	4	3	1	59	49	84	-35
29	1	1	0	60	1	1	0
30	22	9	13	61	1	1	0
31	7	3	4	62	6	3	3

TABLE 9: COMPARISON OF OBSERVED AND CALCULATED TRIPS

TURKEY RUN(CONTINUED)

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
63	1	1	0	94	36	19	17
64	2	1	1	95	3	2	1
65	11	10	1	96	4	5	-1
66	2	1	1	97	1	1	0
67	2	1	1	98	1	1	0
68	1	1	0	99	7	7	0
69	12	9	3	100	74	187	-113
70	1	1	0	101	2	3	-1
71	3	3	0	102	1	1	0
72	1	1	0	103	1	1	0
73	2	1	1	104	1	1	0
74	1	1	0	105	17	3	14
75	5	4	1	106	8	9	-1
76	1	0	1	107	17	10	7
77	53	19	34	108	2	2	0
78	4	2	2	109	1	1	0
79	1	0	1	110	3	2	1
80	8	7	1	111	1	2	-1
81	17	18	-1	112	1	0	1
82	60	55	5	113	1	0	1
83	2	2	0	114	1	1	0
84	5	5	0	115	4	4	0
85	1	1	0	116	1	0	1
86	1	1	0	117	1	2	-1
87	3	3	0	118	3	6	-3
88	2	1	1	119	5	5	0
89	6	3	3	120	7	7	0
90	1	1	0	121	1	3	-2
91	1	1	0	122	3	2	1
92	1	0	1	123	1	1	0
93	1	0	1	124	2	2	0

TABLE 9: COMPARISON OF OBSERVED AND CALCULATED TRIPS

TURKEY RUN (CONTINUED)

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
125	1	2	-1	156	2	26	-24
126	1	2	-1	157	1	1	0
127	7	6	1	158	1	0	1
128	11	9	2	159	1	1	0
129	1	2	-1	160	1	1	0
130	1	7	-6	161	1	1	0
131	1	2	-1	162	1	2	-1
132	1	0	1	163	1	7	-6
133	1	1	0	164	1	1	0
134	1	1	0	165	1	1	0
135	1	1	0	166	1	2	-1
136	5	1	4	167	2	16	-14
137	2	8	-6	168	1	0	1
138	2	2	0	169	1	1	0
139	1	0	1	170	1	1	0
140	1	1	0	171	1	1	0
141	1	3	-2	172	1	1	0
142	2	7	-5	173	1	1	0
143	4	7	-3	174	1	3	-2
144	1	2	-1	175	1	5	-4
145	2	4	-2	176	1	2	-1
146	70	53	17	177	1	2	-1
147	1	1	0	178	1	0	1
148	5	8	-3	179	1	2	-1
149	1	4	-3	180	1	0	1
150	1	2	-1	181	2	5	-3
151	1	0	1	182	1	1	0
152	1	6	-5	183	1	2	-1
153	1	2	-1	184	1	1	0
154	2	12	-10	185	1	0	1
155	1	2	-1	186	1	3	-2

TABLE 9: COMPARISON OF OBSERVED AND CALCULATED TRIPS

TURKEY RUN (CONCLUDED)

Obs. No.	Obs.	Est.	Diff.	Obs. No.	Obs.	Est.	Diff.
187	1	2	-1	207	1	0	1
188	1	3	-2	208	1	3	-2
189	1	6	-5	209	1	1	0
190	1	4	-3	210	1	0	1
191	1	0	1	211	1	0	1
192	1	7	-6	212	1	1	0
193	1	0	1	213	1	0	1
194	1	2	-1	214	1	3	-2
195	1	1	0	215	1	1	0
196	1	1	0	216	1	2	-1
197	1	0	1	217	2	17	-15
198	1	2	-1	218	1	0	1
199	1	29	-28	219	1	3	-2
200	1	0	1	220	1	0	1
201	1	0	1	221	1	1	0
202	1	1	0	222	1	1	0
203	1	2	-1	223	3	16	-13
204	1	2	-1				
205	1	1	0	Totals	1250	1254	
206	2	18	-16				

TABLE 10: DETERMINATION OF RMS AND PERCENT RMS ERRORS

BROWN COUNTY					
CLASS	FREQUENCY	OBSERVED	CALCULATED	RMS ERROR	PERCENT RMS ERROR
1 — 9	196	365	477	9.5	212
10 — 24	15	216	239	21.7	128
25 — 49	6	208	560	146.1	395
50 — 74	-	-	-	-	-
75 — 99	1	86	26	60.0	69
100 — 199	1	128	87	41.1	27
200 — 299	1	202	73	128.9	52
300 — 399	-	-	-	-	-
400 — 499	1	412	172	240.0	53
TOTAL	221	1617	1634	31.3	246

SHADES					
CLASS	FREQUENCY	OBSERVED	CALCULATED	RMS ERROR	PERCENT RMS ERROR
1 — 9	124	214	303	7.1	157
10 — 24	5	75	40	8.4	49
25 — 49	2	71	44	14.2	36
50 — 74	-	-	-	-	-
75 — 99	1	80	58	22.2	25
100 — 199	-	-	-	-	-
200 — 299					
300 — 399					
400 — 499					
TOTAL	132	440	445	7.5	114

TABLE 10: DETERMINATION OF RMS AND PERCENT RMS ERRORS (CONCLUDED)

TIPPECANOE RIVER					
CLASS	FREQUENCY	OBSERVED	CALCULATED	RMS ERROR	PERCENT RMS ERROR
1 — 9	105	173	184	2.4	53
10 — 24	9	148	106	10.7	63
25 — 49	2	61	123	60.6	164
50 — 74	1	53	24	29.2	47
75 — 99	-	-	-	-	-
100 — 199					
200 — 299					
300 — 399					
400 — 499					
TOTAL	117	435	437	9.2	155

TURKEY RUN					
CLASS	FREQUENCY	OBSERVED	CALCULATED	RMS ERROR	PERCENT RMS ERROR
1 — 9	200	427	547	3.8	85
10 — 24	12	191	106	9.1	53
25 — 49	5	179	157	20.3	55
50 — 74	5	306	341	54.4	88
75 — 99	-	-	-	-	-
100 — 199	1	145	102	43.1	29
200 — 299					
300 — 399					
400 — 499					
TOTAL	223	1250	1254	10.1	111

In this type of work, the most significant statistical value which will express the ability of the model to distribute trips is the root-mean-square error. This value is computed in the following manner:

$$\text{RMS error} = \sqrt{\frac{(\text{Observed trips} - \text{Calculated trips})^2}{\text{Number of Counties in the Distribution}}}$$

and indicates the limits within which 2/3's of the deviations between observed and calculated values will fall. Restated, 2/3's of the time, the estimated number of trips can be expected to fall within one RMS error of the actual value, assuming that the trips are normally distributed.

Another term, which perhaps explains the significance in a manner which is more easily understood, is the relative error or the percent RMS error. This value is defined as follows:

$$\text{Percent RMS error} = 100 \times \frac{\text{RMS error}}{\text{Average Number of Trips per County.}}$$

The comparisons of the observed and calculated trips in this study, yield the following RMS errors:

Park	RMS Error	Percent RMS Error
Brown County	31.3	246
Shades	7.5	114
Tippecanoe River	9.2	155
Turkey Run	10.1	111

At first glance, these results would indicate that this method of distribution was not successful; however, a closer examination of both the manner

in which the comparison was made and the significance of the errors would be necessary before the study can be fully evaluated.

A detailed review will reveal that a large percentage of the error can be accounted for by errors in just a few of the many counties within the distribution. The largest errors seem to fall into two main categories. The first error type appears in those counties which contain approximately 20 percent of the total population (dwelling units) within the area of distribution. These are observations such as county 84, in the distribution from Shades, which contain 23.9 percent of the total population and resulted in an overcalculation of 73 trips; or county 100, in the distribution from Turkey Run, which contained 18.7 percent of the total population and resulted in an overcalculation of 113 trips. This was found to be true in many other instances where although the county contained less than 18 percent of the total, it still had a substantial portion of the total population. Consequently, the errors incurred were smaller than in those cases previously stated, but were still observably larger than the random error anticipated.

The second type of error appears in those counties which are within approximately ten miles of the park. In all cases where this existed, a substantial overestimation occurred. County 7, in the distribution from Brown County State Park was such an occurrence. This county, located 2 miles from the Park was overcalculated by 356 trips.

The significance of these errors is easily pointed out. These two types of errors accounted for five of the seven observations in which errors of over 80 trips occurred. Of these five errors, the two in Brown County acccunted for 33.2 percent of the error; the one in Shades accounted

for 27.3 percent of the total error; the one in Tippecanoe River accounted for 23.1 percent of the total error; and the one in Turkey Run accounted for 15.0 percent of its error. Furthermore, if these five errors could be eliminated through some adjustment, the RMS error and percent RMS error would decrease to the following values.

Park	RMS Error	Percent RMS Error
Brown County	21.6	170
Shades	3.7	56
Tippecanoe River	5.0	85
Turkey Run	6.7	74

An explanation of these errors is open to speculation. The first, may be due to the fact that the larger areas are subjected to a greater inter-park competition - an influence, which is not accounted for in the general model. Also, the use of dwelling units as the measure of the county's recreational trip generating ability does not reflect the competition in the larger urban area. It is generally recognized that a need exists for additional work in the field of recreational trip generation by a county. The second error is even more difficult to explain. Possibly in a rural setting the people immediately adjacent to the park are not attracted by those features which are so similar to their own properties.

Regardless of the reason for these errors, a method must be devised to eliminate them. The correction can probably be made by the application of an average park-to-county adjustment factor. This method has been suggested by the Bureau of Public Roads, in their publication Calibrating

and Testing a Gravity Model for any Size Urban Area, (pages IV-48 thru IV-53). They suggest the use of this factor to represent those social and economical variables which are not accounted for in the formulation of the gravity model.

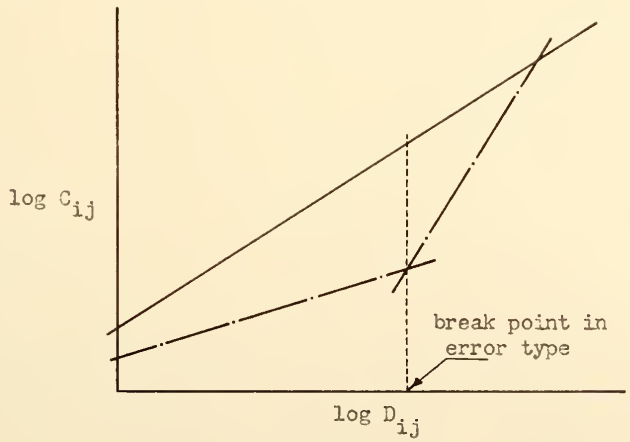
A second look at the results of the comparison, this time from the aspect of the type and distribution of errors, will reveal a definite pattern in the occurrence of errors. Based on the method of comparison, a positive error is caused by an undercalculation in the distribution and a negative error by an overcalculation in the distribution. Furthermore, if the assumptions made in the study are correct, a random occurrence of positive and negative errors would be expected throughout the distribution. These errors are caused by inability of a model to predict human behavior exactly.

The object of this study was to define a model with a single exponent which has the ability of accurately distributing a known number of recreational trips. This was based on the assumption that the parks serve a single population and on the desire to keep the model in its simpliest form. Therefore, if this assumption was correct, a random distribution should be apparent. The table below indicates that there is a definite pattern in the errors.

	In-State			Out-of-State		
Park	Average Distance	Percent (+)	Percent (-)	Average Distance	Percent (+)	Percent (-)
Brown County	102	51	16	223	19	40
Shades	108	49	9	192	16	35
Tippecanoe River	104	72	7	196	27	41
Turkey Run	114	57	8	219	26	40
Average Park	107	56	10	208	22	39

The trips from in-state counties tend to be undercalculated (greater percentage of positive errors) while the trips from out-of-state counties tend to be overcalculated (greater percentage of negative errors).

In general, it can be stated that a trip from an out-of-state county will be generated from a further point than a trip from an in-state county. Therefore, it can be assumed that, in general, the positive errors are occurring in the close counties, and the negative errors are occurring in the more distant counties. Based on this assumption, and recalling the theory behind the determination of a single exponent model, it can be seen that some of the error could be eliminated by assuming two populations, each with its own exponent.



The smaller slope for those closer counties, would result in a larger number of trips being distributed to these counties, while the larger slope for the distant counties, would result in a smaller number of trips being distributed to those counties. This would result in the required correction of the calculated values.

Lastly, a comment is necessary on the method used to test the significance of the distribution. In the procedure used, a given number of trips were distributed by the gravity model, and then a comparison was made on each county individually. However, because of the small sample size connected with each of the individual counties, the magnitude of the errors were quite deceiving and very erratic. If the counties were grouped into sections before the comparison was made, some of these distorted errors would be removed. For example, assume the existence of a hypothetical section comprised of seven counties. The theoretical distribution has been made and a comparison based on individual counties has been performed.

County	Observed Trips	Calculated Trips	Difference	Percent Error
1	25	20	+5	20
2	12	16	-4	-33
3	1	0	+1	100
4	2	1	+1	50
5	9	6	+3	33
6	1	3	-2	-200
7	1	2	-1	100
Section	51	48	+3	6

The last column, which indicated the percent error, reveals errors of greater than 100 percent in three of the counties. Of special interest is the 100 percent error found in counties 3 and 7 due to an error of only one trip. However, if the seven counties had been considered as one section with 51 observed trips and 48 calculated trips, the error would have been only 6 percent. This problem is not unique, but has been found to exist in similar cases where a gravity model was used with a small number of observations (5).

In conclusion, a great deal of additional work must be done with the gravity model before it can be used as a satisfactory distribution method. The analysis of the results of this study indicate that there are many refinements which can be made, but even more significant, that there are several refinements possible which will definitely improve the usage of the gravity model.

CONCLUSIONS

From the results of this study it is concluded:

(1) That recreational trips to state parks can be distributed by use of a gravity model, but additional research is still needed.

(2) That at least two different population types are served by a single state park.

(3) That the total number of recreational trips attracted to a state park can be predicted with a regression model based on the characteristics of the park.

(4) That state parks service different overall areas and can be classified as local or state-wide attractors based on the size of the area they serve.

(5) That between 65 and 68 percent of the total weekly state park trips will be made on the weekend.

(6) That approximately 90 percent of the total trips to a state park, which would not be classified as local, will originate from an area within 152 miles of the park.

(7) That 70 percent of the total trips made on a weekend occur on Sundays.

(8) That the peak interval of arrival on Friday is the hour between 7:00 and 8:00 PM; on Sunday is the hour between 12:00 noon and 1:00 PM; and on Saturday is between the hours of 10:00 AM and 3:00 PM.

SUGGESTED RESEARCH

The following are suggested as areas of future study:

(1) Determination of a two exponent model, with one term defined for near counties, and the second for far counties.

(2) Determination of a regression model for the prediction of the number of recreational trips that a residential area (county) can generate based on the characteristics of the area and its inhabitants.

(3) Determination of a system of classification of State Recreational Areas according to the size of area served, to distinguish between local and state-wide attractors.

(4) Determination of a set of special constants to eliminate those errors which are not random.

(5) Determination of a new method of analyzing data when the sample size is small.

LIST OF REFERENCES

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1. Carrothers, G. A. P., "An Historical Review of the Gravity and Potential Concepts of Human Interaction," Journal of the American Institute of Planners, Vol. XXII, No. 2, Spring, 1956.

2. Isard, W., Methods of Regional Analysis: An Introduction to Regional Science, Technology Press of MIT & John Wiley & Sons, Inc., New York, 1960.

3. Hansen, W. G., "Evaluation of Gravity Model Trip Distribution Procedures," Highway Research Board, Bulletin 347, 1962.

4. Voorhees, A. M., "The Nature and Uses of Models in City Planning," Journal of the American Institute of Planners, Vol. XXV, No. 2, May, 1959.

5. Smith, B. L., An Application of Gravity Model Theory Using a Small Sample of Origin-Destination Data, PhD. Thesis, Purdue University, 1963.

6. Dieter, K. H., "Distribution of Work Trip's in Toronto," Journal of the City Planning Division, Proceedings of American Society of Civil Engineers, Vol. 88, CP1, August, 1962.

7. Voorhees, A. M., "A General Theory of Traffic Movement," 1955 Proceedings, Institute of Traffic Engineers, 1955.

8. Voorhees, A. M., "Forecasting Peak Hours of Travel," Highway Research Board, Bulletin 203, 1958.

9. Casey, H. J., "The Law of Retail Gravitation Applied to Traffic Engineering," Traffic Quarterly, The ENO Foundation for Highway Traffic Control, Vol. IX, No. 3, July, 1955.

10. Eisinger, R. M., "The Development of Synthetic Traffic Assignable to Rural Highways," a Paper Prepared for Presentation at 43rd Annual Meeting of the Highway Research Board, January, 1964.

11. Colwell, R. C., "Interaction Between Transportation and Urban Economic Growth," Highway Research Record, No. 2, 1963.

12. Future Highways and Urban Growth, Wilbur Smith & Associates, New Haven, Connecticut, 1961.

13. Schmidt, R. E., and M. E. Campbell, Highway Traffic Estimation, The ENO Foundation for Highway Traffic Control, Saugatuck, Connecticut, 1956.

14. Report by the Outdoor Recreation Resource Review Commission, Outdoor Recreation for America, Washington, D. C., 1962.

15. Report of the Outdoor Recreation Resource Review Commission, Water for Recreation - Value and Opportunities, Study Report 10, 1962.

16. Report of Outdoor Recreation Resource Review Commission, Participation in Outdoor Recreation: Factors Affecting Demand Among American Adults, Study Report 20, 1962.

17. Report of Outdoor Recreation Resource Review Commission, Projections to the Years 1976 and 2000: Economic Growth, Population, Labor Force and Leisure, and Transportation, Study Report 23, 1962.

18. Report of Outdoor Recreation Resource Review Commission, Trends in American Living and Outdoor Recreation, Study Report 22, 1962.

19. Report of Outdoor Recreation Resource Review Commission, Prospective Demand for Outdoor Recreation, Study Report 26, 1962.

20. Indiana Department of Conservation, Division of State Parks, 14th Annual Report of the Division of State Parks Indiana Department of Conservation for July 1, 1961 - June 30, 1962, 1963.

21. Indiana Department of Conservation, Division of State Parks, Description of Properties and Facilities Operated by the Indiana Department of Conservation, Division of State Parks, 1963.

22. State Division of Recreation, Department of Parks and Recreation, "Governor's Conference on Recreation Policy and Program of the State of California," Proceedings, October, 1962.

23. California Public Outdoor Recreation Plan Committee, California Public Outdoor Recreation Plan, Part 1, 1960.

24. Devaney, F. J., "Trip Generation Characteristics of Outdoor Recreation Areas," Engineering Bulletin of Purdue University, Proceedings of the 49th Annual Road School, 1963.

25. Clawson, M., "Implications of Recreational Needs for Highway Improvements," Highway Research Board, Bulletin 311, 1961.

26. Sessoms, D. H., "New Bases for Recreation Planning," Journal of the American Institute of Planners, Vol. XXX, No. 1, February 1964.

27. Hutchinson, J. L., Principles of Recreation, A. S. Barnes and Company, New York, 1949.

28. Williams, W. R., Recreation Places, Reinhold Publishing Corporation, New York, 1957.

29. Cougill, K. R., "Suggested Criteria for Evaluating Areas Proposed for Inclusion in the State Park System," Planning and Civic Comment, December, 1954.

30. Tilden, F., The National Parks - What They Mean To You And Me, Alfred A. Knopf, New York, 1951.

31. Plummer, A. V., L. G. Wilkie, and R. F. Gran, "Holiday and Summer Weekend Traffic Survey," Highway Research Board, Bulletin 297, 1961.

32. Crevo, C. C., Characteristics of Summer Weekend Recreational Travel, Bureau of Highway Traffic, Yale University, May, 1962.

33. Foltz, D., "History and Development of Water Resource Projects in Indiana," Engineering Bulletin of Purdue University, Proceedings of the 49th Annual Road School, 1963.

34. Schellie, K. L., "Area Planning for Water Projects," Engineering Bulletin of Purdue University, Proceedings of the 49th Annual Road School, 1963.

35. "Recreational Uses of Hydroelectric Reservoirs," Civil Engineering, Vol. 33, No. 8, August, 1963.

36. Ostle, Bernard, Statistics in Research, The Iowa State University Press, Iowa, 1963.

37. McCracken, D. D., A Guide to Fortran Programming, John Wiley & Sons, New York, 1961.

38. U. S. Bureau of the Census, County and City Data Book, 1962 (a Statistical Abstract Supplement), U. S. Government Printing Office, Washington 25, D. C., 1962.

39. U. S. Department of Commerce, Bureau of Public Roads, Office of Planning, Calibrating and Testing a Gravity Model for Any Size Urban Area, July, 1963.

APPENDIX A

14. Report by the Outdoor Recreation Resource Review Commission, Outdoor Recreation for America, Washington, D. C., 1962.

15. Report of the Outdoor Recreation Resource Review Commission, Water for Recreation - Value and Opportunities, Study Report 10, 1962.

16. Report of Outdoor Recreation Resource Review Commission, Participation in Outdoor Recreation: Factors Affecting Demand Among American Adults, Study Report 20, 1962.

17. Report of Outdoor Recreation Resource Review Commission, Projections to the Years 1976 and 2000: Economic Growth, Population, Labor Force and Leisure, and Transportation, Study Report 23, 1962.

18. Report of Outdoor Recreation Resource Review Commission, Trends in American Living and Outdoor Recreation, Study Report 22, 1962.

19. Report of Outdoor Recreation Resource Review Commission, Prospective Demand for Outdoor Recreation, Study Report 26, 1962.

20. Indiana Department of Conservation, Division of State Parks, 14th Annual Report of the Division of State Parks Indiana Department of Conservation for July 1, 1961 - June 30, 1962, 1963.

21. Indiana Department of Conservation, Division of State Parks, Description of Properties and Facilities Operated by the Indiana Department of Conservation, Division of State Parks, 1963.

22. State Division of Recreation, Department of Parks and Recreation, "Governor's Conference on Recreation Policy and Program of the State of California," Proceedings, October, 1962.

23. California Public Outdoor Recreation Plan Committee, California Public Outdoor Recreation Plan, Part 1, 1960.

24. Devaney, F. J., "Trip Generation Characteristics of Outdoor Recreation Areas," Engineering Bulletin of Purdue University, Proceedings of the 49th Annual Road School, 1963.

25. Clawson, M., "Implications of Recreational Needs for Highway Improvements," Highway Research Board, Bulletin 311, 1961.

26. Sessoms, D. H., "New Bases for Recreation Planning," Journal of the American Institute of Planners, Vol. XXX, No. 1, February 1964.

27. Hutchinson, J. L., Principles of Recreation, A. S. Barnes and Company, New York, 1949.

28. Williams, W. R., Recreation Places, Reinhold Publishing Corporation, New York, 1957.

APPENDIX A

Tables 11 through 15 which are found in this Appendix are a presentation of the observed distribution of weekend trips. The county number identifying each set of observations is interpreted as follows: the first number refers to the county observation number within the park and the second number (in parenthesis) refers to the code number within the state as listed in Appendix B. In these tables, a cross (+) replacing any weekly observation represents the non-occurrence of trips for that weekend.

		COUNTY NUMBER										
		COUNTIES FROM INDIANA	1(1)	2(2)	3(3)	4(4)	5(5)	6(6)	7(7)	8(8)	9(9)	10(10)	11(11)
DISTANCE			171	157	16	132	123	73	2	113	125	90	63
WEEKEND OF	7-12		+	8	221	+	2	11	42	1	+	8	7
	7-19		+	8	210	2	+	14	50	1	1	4	3
	7-26		+	15	175	+	2	7	42	1	4	7	4
	8-2		+	11	199	3	+	4	23	+	3	6	2
	8-9		4	8	207	1	2	9	70	1	4	8	5

		12(12)	13(13)	14(14)	15(15)	16(16)	17(17)	18(18)	19(19)	20(20)	21(21)	22(22)	23(23)
DISTANCE		90	80	75	82	44	177	104	94	188	83	88	110
WEEKEND OF	7-12	3	+	1	6	18	1	10	2	4	1	8	2
	7-19	5	1	2	9	15	1	13	5	4	2	10	2
	7-26	1	2	3	3	16	+	7	1	3	4	7	1
	8-2	+	+	3	3	10	+	8	1	7	9	6	+
	8-9	+	+	7	10	13	+	24	3	3	2	10	1

		24(24)	25(25)	26(26)	27(27)	28(28)	29(29)	30(30)	31(31)	32(32)	33(33)	34(34)	35(35)
DISTANCE		78	143	107	106	40	68	65	83	53	90	101	132
WEEKEND OF	7-12	1	+	1	3	6	14	14	+	13	8	5	3
	7-19	+	+	1	17	4	17	12	3	23	15	10	1
	7-26	3	2	6	5	5	12	16	+	11	17	11	2
	8-2	2	+	1	7	5	14	3	1	16	5	8	3
	8-9	5	1	4	3	6	16	10	4	15	13	11	+

TABLE II: WEEKEND TRIPS TO BROWN COUNTY STATE PARK

		COUNTY NUMBER											
		36(36)	37(37)	38(38)	39(39)	40(40)	41(41)	42(42)	43(43)	44(44)	45(45)	46(46)	47(47)
DISTANCE		34	154	135	62	37	28	81	163	191	193	191	40
WEEKEND OF	7-12	24	+	8	3	7	86	+	4	1	25	1	11
	7-19	41	4	1	8	5	124	5	1	+	19	3	12
	7-26	32	1	2	4	4	56	15	2	+	16	4	7
	8-2	17	+	4	3	4	93	3	2	+	23	6	11
	8-9	22	1	+	9	11	69	4	2	1	18	6	16
		48(48)	49(49)	50(50)	51(51)	52(52)	53(53)	54(54)	55(55)	56(56)	57(57)	58(58)	59(59)
DISTANCE		84	49	168	64	122	16	83	25	144	170	87	63
WEEKEND OF	7-12	15	309	5	2	1	133	2	35	+	1	+	2
	7-19	24	505	3	+	2	166	2	44	+	6	2	+
	7-26	13	392	2	3	+	106	6	20	1	1	4	5
	8-2	20	380	1	1	8	120	3	44	+	3	+	1
	8-9	28	474	1	+	2	114	9	41	1	1	5	1
		60(60)	61(61)	62(62)	63(63)	64(64)	65(65)	66(66)	67(67)	68(68)	69(69)	70(70)	71(71)
DISTANCE		34	89	120	88	188	150	149	61	126	59	65	191
WEEKEND OF	7-12	3	+	2	+	3	+	+	3	2	3	5	6
	7-19	4	1	+	+	2	2	+	3	1	2	4	9
	7-26	1	+	1	1	3	1	1	+	+	5	8	6
	8-2	2	1	1	2	1	3	1	3	1	1	4	8
	8-9	4	+	4	1	+	+	+	7	4	3	4	8

TABLE II: WEEKEND TRIPS TO BROWN COUNTY STATE PARK (CONTINUED)

		COUNTY NUMBER											
		72(72)	73(73)	74(74)	75(75)	76(76)	77(77)	78(78)	79(79)	80(80)	81(81)	82(82)	83(83)
DISTANCE		58	45	130	166	197	70	83	107	87	95	128	106
WEEKEND OF	7-12	1	44	2	2	+	2	+	12	2	+	4	1
	7-19	3	28	+	1	+	1	+	14	3	+	6	+
	7-26	5	21	+	1	1	+	3	6	1	1	7	+
	8-2	+	16	+	+	+	2	+	16	+	+	1	+
	8-9	1	25	+	+	+	+	1	13	4	+	9	2
		84(84)	85(85)	86(86)	87(87)	88(88)	89(89)	90(90)	91(91)	92(92)	COUNTIES FROM ILLINOIS	93(9)	94(10)
DISTANCE		75	126	114	125	55	110	154	126	152		255	169
WEEKEND OF	7-12	14	1	2	3	+	11	+	+	+		+	+
	7-19	8	4	+	+	4	7	1	+	+		1	1
	7-26	10	2	+	+	1	3	2	3	2		+	+
	8-2	8	2	+	+	5	4	2	6	2		+	1
	8-9	16	1	+	2	5	7	+	2	2		+	1
		95(12)	96(15)	97(16)	98(17)	99(19)	100(21)	101(22)	102(23)	103(27)	104(32)	105(36)	106(38)
DISTANCE		90	118	234	96	287	146	256	96	165	228	323	161
WEEKEND OF	7-12	+	1	19	+	+	+	2	+	1	+	+	1
	7-19	2	+	22	+	1	+	6	5	+	+	+	1
	7-26	1	+	12	+	+	1	3	1	+	+	+	+
	8-2	+	+	19	1	+	1	+	+	+	+	1	+
	8-9	+	+	22	+	+	+	1	2	4	+	+	+

TABLE II: WEEKEND TRIPS TO BROWN COUNTY STATE PARK (CONTINUED)

		COUNTY NUMBER											
		107(39)	108(40)	109(45)	110(46)	111(49)	112(51)	113(53)	114(54)	115(56)	116(57)	117(58)	118(60)
DISTANCE		215	120	266	179	273	91	217	211	303	194	174	217
WEEKEND OF	7-12	1	1	1	1	3	+	1	1	2	+	+	1
	7-19	+	+	4	+	+	1	+	+	+	+	1	+
	7-26	+	+	+	+	+	+	+	+	2	1	+	+
	8-2	+	+	+	1	1	+	+	+	+	1	+	+
	8-9	+	1	4	+	+	+	+	+	+	6	5	+
		119(61)	120(62)	121(67)	122(68)	123(69)	124(70)	125(72)	126(74)	127(81)	128(84)	129(90)	130(92)
DISTANCE		160	274	247	189	251	148	236	171	340	223	232	115
WEEKEND OF	7-12	1	1	+	+	1	+	+	+	2	+	+	+
	7-19	2	+	+	1	+	2	+	1	+	2	+	3
	7-26	+	+	+	+	+	+	+	+	1	+	1	2
	8-2	+	+	+	+	+	+	2	+	1	1	+	2
	8-9	+	+	2	+	+	+	2	+	+	1	+	+
		131(93)	132(94)	133(95)	134(97)	135(99)	136(101)	137(102)	COUNTIES FROM OHIO	138(2)	139(6)	140(7)	141(9)
DISTANCE		105	307	198	139	232	315	222		197	183	319	104
WEEKEND OF	7-12	1	+	1	+	1	+	+		5	+	1	8
	7-19	+	1	+	+	+	1	1		+	1	+	8
	7-26	+	+	+	1	+	+	+		+	+	+	18
	8-2	+	+	+	+	+	+	+		+	+	+	16
	8-9	+	+	+	+	+	+	2		+	+	+	4

TABLE II: WEEKEND TRIPS TO BROWN COUNTY STATE PARK (CONTINUED)

		COUNTY NUMBER											
		142(12)	143(13)	144(14)	145(15)	146(18)	147(19)	148(20)	149(25)	150(26)	151(29)	152(30)	153(31)
DISTANCE		174	133	147	371	350	136	202	210	231	157	280	111
WEEKEND OF	7-12	+	3	1	+	1	+	1	15	1	+	+	48
	7-19	8	3	+	1	2	7	+	1	+	+	1	37
	7-26	3	5	+	+	+	+	2	+	+	2	+	26
	8-2	3	3	+	+	+	+	+	3	+	+	+	43
	8-9	+	+	+	+	+	+	+	2	1	2	+	58
		154(32)	155(36)	156(39)	157(40)	158(41)	159(46)	160(47)	161(48)	162(50)	163(51)	164(52)	165(54)
DISTANCE		249	166	310	226	344	199	341	263	397	244	328	162
WEEKEND OF	7-12	3	1	+	+	+	1	+	+	+	+	+	1
	7-19	+	+	+	1	1	+	1	2	+	2	+	+
	7-26	+	+	+	+	+	+	+	+	+	+	+	+
	8-2	+	+	+	+	+	+	+	4	+	+	+	1
	8-9	+	+	2	+	+	+	+	+	1	6	1	+
		166(55)	167(57)	168(63)	169(66)	170(68)	171(70)	172(74)	173(76)	174(77)	175(78)	176(79)	177(80)
DISTANCE		163	141	188	206	125	283	275	346	344	384	325	214
WEEKEND OF	7-12	1	14	1	+	1	1	1	+	1	+	+	2
	7-19	3	30	+	1	3	+	+	1	+	+	1	+
	7-26	+	30	+	+	4	+	+	2	1	+	+	1
	8-2	2	12	+	+	2	+	+	+	1	1	+	+
	8-9	+	23	+	+	1	+	+	+	+	+	+	+

TABLE II: WEEKEND TRIPS TO BROWN COUNTY STATE PARK (CONTINUED)

		COUNTY NUMBER											
		178(81)	179(82)	180(83)	181(86)	182(87)	COUNTIES FROM KENTUCKY	183(5)	184(8)	185(19)	186(30)	187(33)	188(34)
DISTANCE		192	230	124	202	246		188	125	112	140	191	145
WEEKEND OF	7-12	+	1	+	1	+		+	+	6	+	1	5
	7-19	1	1	1	1	+		+	2	1	1	+	2
	7-26	1	+	+	1	+		+	+	3	3	+	+
	8-2	1	+	2	+	11		+	1	2	+	+	+
	8-9	+	+	8	+	+		1	+	5	+	+	3
		189(37)	190(45)	191(47)	192(49)	193(52)	194(54)	195(56)	196(57)	197(59)	198(79)	199(82)	200(93)
DISTANCE		121	238	131	167	91	179	91	156	112	240	125	92
WEEKEND OF	7-12	1	+	+	+	+	+	26	+	7	+	+	+
	7-19	+	1	+	+	1	1	33	+	4	+	+	+
	7-26	+	+	1	1	+	+	18	1	1	+	+	+
	8-2	+	1	+	+	+	+	32	+	1	+	+	+
	8-9	+	+	+	+	1	1	39	+	1	1	1	1
		201(96)	202(106)	203(109)	COUNTIES FROM MICHIGAN	204(11)	205(24)	206(30)	207(33)	208(38)	209(41)	210(43)	211(61)
DISTANCE		146	110	175		222	513	237	284	263	318	291	328
WEEKEND OF	7-12	+	+	+		+	+	1	+	+	+	+	+
	7-19	+	2	1		+	+	+	1	1	3	+	1
	7-26	1	+	+		+	+	+	+	1	+	+	+
	8-2	+	+	+		1	+	+	+	+	+	+	+
	8-9	+	+	+		+	1	1	+	+	+	3	+

TABLE II: WEEKEND TRIPS TO BROWN COUNTY STATE PARK (CONTINUED)

		COUNTY NUMBER											
		212(63)	213(73)	214(82)	COUNTIES FROM WISCONSIN	215(5)	216(8)	217(40)	218(52)	COUNTIES FROM MISSOURI	219(50)	220(63)	221(95)
DISTANCE		333	358	318		445	409	329	474		270	337	233
WEEKEND OF	7-12	1	1	+		+	+	1	+		+	+	+
	7-19	+	+	2		+	+	+	1		+	+	2
	7-26	+	+	2		+	+	1	+		1	+	3
	8-2	+	+	1		1	+	2	+		+	+	2
	8-9	+	+	2		+	1	+	+		+	1	1
DISTANCE													
WEEKEND OF	7-12												
	7-19												
	7-26												
	8-2												
	8-9												
DISTANCE													
WEEKEND OF	7-12												
	7-19												
	7-26												
	8-2												
	8-9												

TABLE II: WEEKEND TRIPS TO BROWN COUNTY STATE PARK (CONCLUDED)

		COUNTY NUMBER										
		COUNTIES FROM INDIANA	1(1)	2(2)	3(3)	4(4)	5(5)	6(6)	7(7)	8(8)	9(9)	10(10)	11(12)
DISTANCE			77	84	77	102	37	48	84	79	74	151	56
WEEKEND OF	7-12		1	10	+	+	4	+	+	+	+	+	+
	7-19		1	6	8	+	4	2	+	3	1	1	1
	7-26		2	4	+	+	5	1	1	1	+	2	+
	8-2		2	12	1	+	1	1	+	+	2	+	+
	8-9		1	5	1	1	1	2	+	+	2	+	3

		12(15)	13(17)	14(18)	15(20)	16(22)	17(23)	18(24)	19(27)	20(29)	21(30)	22(32)	23(33)
DISTANCE		100	104	18	110	150	97	72	33	22	26	57	24
WEEKEND OF	7-12	+	+	20	+	+	1	1	3	4	1	2	1
	7-19	2	1	76	2	2	+	+	9	12	7	+	15
	7-26	1	1	26	+	+	+	+	7	1	2	1	7
	8-2	+	1	47	2	+	+	+	5	6	3	+	5
	8-9	+	+	29	1	+	+	+	10	2	1	1	8

		24(34)	25(35)	26(38)	27(39)	28(40)	29(41)	30(43)	31(44)	32(45)	33(46)	34(47)	35(48)
DISTANCE		50	59	49	116	98	58	85	118	165	136	108	2
WEEKEND OF	7-12	1	+	+	+	+	3	+	1	1	+	1	56
	7-19	5	2	3	2	1	3	+	+	2	+	+	162
	7-26	4	+	2	+	+	2	1	+	4	+	+	83
	8-2	+	1	2	+	+	2	1	+	+	+	1	119
	8-9	6	5	1	+	+	3	1	+	6	1	1	80

TABLE 12: WEEKEND TRIPS TO MOUNDS STATE PARK

		COUNTY NUMBER											
		36(49)	37(50)	38(51)	39(52)	40(54)	41(55)	42(56)	43(57)	44(58)	45(60)	46(61)	47(63)
DISTANCE		37	100	132	59	70	65	114	97	113	91	100	156
WEEKEND OF	7-12	35	1	+	+	+	+	+	+	+	+	+	+
	7-19	55	+	1	2	+	2	+	3	1	+	1	1
	7-26	37	+	+	2	+	+	+	+	+	2	1	+
	8-2	39	1	+	+	+	1	1	+	+	+	+	+
	8-9	49	+	+	+	1	+	+	+	+	+	+	+
		48(66)	49(67)	50(68)	51(69)	52(70)	53(71)	54(72)	55(73)	56(75)	57(79)	58(80)	59(81)
DISTANCE		98	75	40	90	49	123	118	46	115	77	31	67
WEEKEND OF	7-12	+	+	2	+	+	1	+	+	+	4	3	1
	7-19	1	+	3	1	1	4	+	+	1	2	2	+
	7-26	+	+	5	+	1	+	+	1	+	4	3	+
	8-2	+	1	7	+	1	+	1	+	+	+	1	+
	8-9	+	+	2	+	1	+	+	+	+	+	1	+
		60(82)	61(83)	62(85)	63(88)	64(89)	65(90)	66(91)	67(92)	COUNTIES FROM OHIO	68(13)	69(18)	70(25)
DISTANCE		196	117	53	125	49	68	92	79		134	272	163
WEEKEND OF	7-12	2	+	1	+	2	+	1	+		1	+	+
	7-19	1	+	1	+	1	1	1	1		+	1	+
	7-26	+	+	1	+	4	+	+	1		+	+	+
	8-2	+	1	2	1	2	+	2	+		+	+	1
	8-9	+	+	+	+	2	+	+	2		+	+	+

TABLE 12: WEEKEND TRIPS TO MOUNDS STATE PARK (CONTINUED)

		COUNTY NUMBER											
		71(31)	72(48)	73(51)	74(52)	75(57)	76(60)	77(83)	COUNTIES FROM MICHIGAN	78(11)	79(13)	80(14)	81(33)
DISTANCE		112	190	158	242	88	206	102		154	122	143	215
WEEKEND OF	7-12	+	+	1	+	1	1	+		1	+	+	+
	7-19	+	+	+	+	+	+	5		+	+	+	+
	7-26	1	1	+	+	+	+	+		+	+	1	1
	8-2	1	+	+	1	1	+	1		+	1	+	+
	8-9	+	+	+	+	+	+	+		+	+	+	+

		82(58)	83(67)	84(82)	COUNTIES FROM ILLINOIS	85(10)	86(16)	87(45)	88(53)	89(58)	90(69)	91(92)	COUNTIES FROM KENTUCKY
DISTANCE		221	291	255		137	198	247	208	189	270	104	
WEEKEND OF	7-12	+	+	+		+	+	+	1	+	+	1	
	7-19	+	+	+		+	+	+	+	+	+	+	
	7-26	+	1	2		1	1	+	+	1	+	+	
	8-2	1	+	+		+	1	+	+	+	1	+	
	8-9	+	+	+		+	1	1	+	+	+	+	

		92(75)	COUNTIES FROM WISCONSIN	93(51)	COUNTIES FROM MISSOURI	94(95)
DISTANCE		271		286		277
WEEKEND OF	7-12	1		+		+
	7-19	+		+		+
	7-26	+		1		+
	8-2	+		+		1
	8-9	+		+		+

TABLE 12: WEEKEND TRIPS TO MOUNDS STATE PARK (CONCLUDED)

		COUNTY NUMBER										
		COUNTIES FROM INDIANA	1(1)	2(2)	3(3)	4(4)	5(5)	6(6)	7(7)	8(8)	9(9)	10(10)	11(11)
DISTANCE			158	151	99	66	120	35	94	61	78	182	54
WEEKEND OF	7-12		+	1	+	3	+	4	1	3	+	+	3
	7-19		+	4	2	2	+	20	+	7	1	1	4
	7-26		3	7	1	2	+	19	+	+	1	+	3
	8-2		+	5	+	1	+	12	1	3	2	+	4
	8-9		+	12	+	1	1	17	+	1	2	+	3
		12(12)	13(14)	14(15)	15(16)	16(17)	17(18)	18(20)	19(23)	20(24)	21(25)	22(26)	23(27)
DISTANCE		48	129	164	116	175	155	150	29	127	101	137	106
WEEKEND OF	7-12	2	+	+	+	+	3	+	13	+	+	+	2
	7-19	9	+	+	+	+	3	2	18	+	+	+	1
	7-26	12	1	2	+	1	1	3	11	1	+	1	+
	8-2	6	+	+	+	1	5	1	37	+	3	1	1
	8-9	2	+	+	1	+	2	+	9	+	1	+	2
		24(28)	25(29)	26(30)	27(31)	28(32)	29(33)	30(34)	31(35)	32(36)	33(37)	34(38)	35(39)
DISTANCE		94	61	83	175	43	107	82	126	130	87	132	145
WEEKEND OF	7-12	1	11	1	+	11	+	2	1	1	+	+	+
	7-19	+	7	+	+	20	+	9	1	+	1	+	1
	7-26	1	10	4	+	7	3	6	2	+	+	1	2
	8-2	+	7	1	1	17	1	3	1	+	+	+	+
	8-9	1	6	+	+	9	5	5	1	+	1	+	+

TABLE 13: WEEKEND TRIPS TO SHADES STATE PARK

		COUNTY NUMBER											
		36(41)	37(42)	38(43)	39(44)	40(45)	41(46)	42(47)	43(48)	44(49)	45(50)	46(51)	47(52)
DISTANCE		78	111	125	182	126	137	112	81	57	121	129	93
WEEKEND OF	7-12	3	1	+	+	8	2	+	5	55	1	+	1
	7-19	4	2	2	2	7	2	1	8	90	1	+	+
	7-26	4	1	2	1	2	1	+	12	84	1	+	+
	8-2	+	+	1	+	7	5	1	18	98	1	1	1
	8-9	+	+	+	+	5	+	+	3	72	2	+	1
		48(53)	49(54)	50(55)	51(56)	52(60)	53(61)	54(62)	55(64)	56(66)	57(67)	58(69)	59(70)
DISTANCE		88	13	71	75	70	28	192	129	95	43	139	99
WEEKEND OF	7-12	2	45	+	+	+	6	+	+	1	10	+	+
	7-19	3	49	3	4	+	5	+	3	+	7	+	+
	7-26	6	28	1	1	1	4	+	2	+	2	1	+
	8-2	1	45	+	+	1	8	1	2	1	5	+	1
	8-9	+	39	4	1	1	4	+	2	+	2	+	+
		60(71)	61(73)	62(74)	63(75)	64(77)	65(78)	66(79)	67(80)	68(81)	69(82)	70(83)	71(84)
DISTANCE		144	95	189	112	81	166	40	73	129	167	39	53
WEEKEND OF	7-12	3	+	1	+	1	+	33	+	+	+	12	10
	7-19	4	4	1	1	1	+	43	1	1	1	7	9
	7-26	3	+	+	+	1	1	28	1	+	+	3	7
	8-2	4	+	+	1	+	+	23	2	1	+	8	10
	8-9	5	+	+	+	+	+	23	+	+	1	11	12

TABLE 13: WEEKEND TRIPS TO SHADES STATE PARK (CONTINUED)

		COUNTY NUMBER											
		72(85)	73(86)	74(87)	75(89)	76(90)	77(91)	78(92)	COUNTIES FROM ILLINOIS	79(4)	80(9)	81(10)	82(12)
DISTANCE		107	186	170	132	141	67	143		230	194	75	68
WEEKEND OF	7-12	+	6	+	+	1	1	+		1	+	10	1
	7-19	1	1	1	+	+	2	+		+	+	8	+
	7-26	1	2	+	+	1	5	3		+	+	12	+
	8-2	1	1	+	1	2	1	+		+	1	7	+
	8-9	+	1	+	+	+	+	+		+	+	6	+
		83(15)	84(16)	85(17)	86(19)	87(20)	88(21)	89(22)	90(23)	91(25)	92(27)	93(38)	94(45)
DISTANCE		84	159	98	209	129	85	179	58	127	88	92	189
WEEKEND OF	7-12	+	2	1	+	+	+	1	4	+	+	2	+
	7-19	3	5	+	+	+	+	2	1	+	+	2	+
	7-26	+	7	1	+	+	+	3	+	+	2	+	+
	8-2	+	9	1	1	+	1	3	1	1	1	1	2
	8-9	+	12	+	+	1	+	+	+	+	+	2	+
		95(46)	96(49)	97(57)	98(58)	99(59)	100(70)	101(74)	102(81)	103(84)	104(87)	105(90)	106(92)
DISTANCE		123	198	121	127	202	114	98	261	162	126	159	42
WEEKEND OF	7-12	+	+	+	1	+	1	+	+	+	+	+	12
	7-19	+	+	+	+	+	+	+	+	+	+	+	33
	7-26	1	+	+	+	1	+	+	+	1	1	1	14
	8-2	+	+	+	2	+	+	2	1	+	+	+	26
	8-9	2	2	1	2	+	+	+	+	+	+	+	16

TABLE 13: WEEKEND TRIPS TO SHADES STATE PARK (CONTINUED)

		COUNTY NUMBER											
		107(99)	108(101)	COUNTIES FROM OHIO	109(2)	110(18)	111(25)	112(29)	113(31)	114(34)	115(38)	116(45)	117(57)
DISTANCE		154	237		194	367	233	181	167	349	297	267	165
WEEKEND OF	7-12	2	+		+	+	1	+	+	+	+	+	1
	7-19	1	+		+	+	+	+	1	+	1	1	+
	7-26	+	1		2	1	+	+	1	+	+	+	1
	8-2	+	+		+	+	+	+	+	1	+	+	2
	8-9	1	+		+	+	+	1	+	+	+	+	+
		118(76)	COUNTIES FROM MICHIGAN		119(14)	120(33)	121(41)	122(46)	123(50)	124(61)	125(73)	126(82)	COUNTIES FROM KENTUCKY	127(19)
DISTANCE		346			167	282	271	267	355	262	368	332		168
WEEKEND OF	7-12	+			+	+	1	+	+	+	+	+		+
	7-19	1			1	+	+	+	2	+	+	+		+
	7-26	+			+	+	+	+	+	1	+	2		+
	8-2	+			1	1	+	+	1	+	3	+		1
	8-9	+			+	+	+	2	+	+	+	1		+
		128(56)	129(79)	COUNTIES FROM WISCONSIN	130(30)	131(67)	COUNTIES FROM MISSOURI	132(95)					
DISTANCE		183	279		216	265		214					
WEEKEND OF	7-12	+	1		+	1		+					
	7-19	1	+		+	+		1					
	7-26	+	+		+	+		+					
	8-2	+	+		1	+		+					
	8-9	+	+		+	+		+					

TABLE 13: WEEKEND TRIPS TO SHADES STATE PARK (CONCLUDED)

		COUNTY NUMBER										
		COUNTIES FROM INDIANA	1(1)	2(2)	3(3)	4(4)	5(5)	6(6)	7(8)	8(9)	9(10)	10(12)	11(17)
DISTANCE			118	93	148	74	87	84	47	30	222	67	94
WEEKEND OF	7-12		+	2	+	+	+	+	4	12	+	3	+
	7-19		+	18	4	2	+	1	3	10	+	1	1
	7-26		+	9	+	+	+	+	3	15	+	+	+
	8-2		1	20	1	2	1	3	6	24	1	6	4
	8-9		+	16	+	1	+	2	1	13	+	7	3
		12(18)	13(20)	14(21)	15(23)	16(25)	17(27)	18(28)	19(29)	20(30)	21(31)	22(32)	23(33)
DISTANCE			106	70	156	105	27	71	169	92	115	224	104	125
WEEKEND OF	7-12		4	4	+	+	5	1	4	+	+	+	4	1
	7-19		1	27	+	+	10	5	+	3	+	+	1	+
	7-26		+	27	1	+	32	3	1	+	1	+	+	1
	8-2		4	39	1	2	13	5	4	+	+	1	1	+
	8-9		5	34	1	+	12	8	1	4	+	+	+	2
		24(34)	25(35)	26(37)	27(38)	28(40)	29(41)	30(43)	31(44)	32(45)	33(46)	34(47)	35(48)
DISTANCE			54	80	44	109	169	127	51	103	64	36	175	102
WEEKEND OF	7-12		14	2	+	+	1	+	6	+	68	52	+	2
	7-19		14	2	2	+	+	+	15	+	48	12	1	9
	7-26		11	1	+	+	+	1	17	+	53	20	+	4
	8-2		17	2	2	+	+	+	4	2	50	16	+	5
	8-9		37	5	2	2	+	1	4	1	44	12	+	5

TABLE 14: WEEKEND TRIPS TO TIPPECANOE RIVER STATE PARK

		COUNTY NUMBER											
		36(49)	37(50)	38(52)	39(53)	40(54)	41(55)	42(56)	43(57)	44(58)	45(59)	46(63)	47(64)
DISTANCE		106	31	45	151	88	132	71	87	207	198	217	44
WEEKEND OF	7-12	4	32	3	+	+	+	2	+	3	+	+	10
	7-19	33	28	10	+	+	+	2	1	+	+	1	8
	7-26	17	6	5	1	1	+	3	6	+	1	+	9
	8-2	20	13	4	2	2	+	1	12	+	+	+	7
	8-9	14	9	1	1	1	1	+	7	+	+	+	4
		48(66)	49(69)	50(71)	51(73)	52(75)	53(78)	54(79)	55(80)	56(82)	57(84)	58(85)	59(89)
DISTANCE		6	179	51	135	11	207	61	73	257	145	61	145
WEEKEND OF	7-12	20	1	14	+	9	2	5	1	+	1	2	+
	7-19	28	+	6	2	6	+	4	+	+	1	2	1
	7-26	3	+	10	+	7	+	2	1	+	+	2	1
	8-2	19	+	20	1	7	+	8	1	+	+	2	+
	8-9	6	+	20	1	9	+	6	1	1	3	4	+
		60(91)	61(92)	COUNTIES FROM ILLINOIS	62(1)	63(10)	64(16)	65(21)	66(22)	67(27)	68(38)	69(45)	70(46)
DISTANCE		34	69		261	151	105	174	127	123	87	134	95
WEEKEND OF	7-12	11	+		+	+	37	+	1	+	1	+	2
	7-19	7	8		+	+	34	1	5	+	1	2	4
	7-26	1	4		+	1	26	+	3	1	+	+	1
	8-2	1	5		+	+	41	+	1	1	2	+	4
	8-9	+	3		1	+	37	+	1	+	1	1	+

TABLE 14: WEEKEND TRIPS TO TIPPECANOE RIVER STATE PARK (CONTINUED)

		COUNTY NUMBER											
		71(49)	72(50)	73(56)	74(57)	75(58)	76(71)	77(74)	78(81)	79(82)	80(90)	81(92)	82(99)
DISTANCE		144	133	158	162	202	192	174	259	302	198	105	103
WEEKEND OF	7-12	1	+	+	1	+	+	+	1	+	+	+	1
	7-19	+	1	+	1	1	+	+	+	+	+	+	7
	7-26	1	+	+	+	+	+	+	+	+	+	1	3
	8-2	+	+	+	+	+	1	1	+	2	2	+	1
	8-9	+	1	1	+	+	+	+	+	1	+	3	3
		COUNTIES FROM MISSOURI	83(12)	84(95)	COUNTIES FROM KENTUCKY	85(56)	86(117)	COUNTIES FROM WISCONSIN	87(13)	88(40)	89(51)	90(66)	91(67)
DISTANCE			429	316		238	304		258	200	172	234	215
WEEKEND OF	7-12		+	+		+	+		+	1	+	+	1
	7-19		1	+		+	1		1	1	+	+	+
	7-26		+	+		+	+		+	+	+	+	+
	8-2		+	1		1	+		+	1	2	1	1
	8-9		+	1		+	+		+	+	+	+	+
		COUNTIES FROM OHIO	92(2)	93(5)	94(9)	95(12)	96(31)	97(47)	98(48)	99(52)	100(57)	101(71)	102(74)
DISTANCE			168	300	188	203	221	288	199	281	184	260	210
WEEKEND OF	7-12		+	+	+	1	1	+	+	2	1	1	+
	7-19		2	+	+	+	1	+	+	+	1	+	+
	7-26		+	1	1	+	1	+	+	+	+	1	1
	8-2		1	+	+	+	1	+	1	+	1	+	+
	8-9		+	+	+	+	2	1	+	+	1	+	+

TABLE 14: WEEKEND TRIPS TO TIPPECANOE RIVER STATE PARK (CONTINUED)

		COUNTY NUMBER											
		103(77)	104(83)	105(85)	106(86)	COUNTIES FROM MICHIGAN	107(3)	108(11)	109(14)	110(25)	111(33)	112(39)	113(41)
DISTANCE		300	198	269	127		129	74	74	276	200	125	152
WEEKEND OF	7-12	+	1	1	+		+	+	+	+	+	+	+
	7-19	1	+	+	+		+	1	+	1	+	+	1
	7-26	+	+	+	+		+	1	+	+	+	1	+
	8-2	1	+	+	1		1	+	+	+	1	+	+
	8-9	+	+	+	+		+	+	1	+	+	+	+

		114(50)	115(70)	116(80)	117(82)
DISTANCE		283	150	108	260
WEEKEND OF	7-12	+	+	+	+
	7-19	+	+	+	+
	7-26	+	1	+	+
	8-2	+	+	1	+
	8-9	1	+	+	1

DISTANCE					
WEEKEND OF	7-12				
	7-19				
	7-26				
	8-2				
	8-9				

TABLE 14: WEEKEND TRIPS TO TIPPECANOE RIVER STATE PARK (CONCLUDED)

		COUNTY NUMBER										
		COUNTIES FROM INDIANA	1 (1)	2(2)	3(3)	4(4)	5(5)	6(6)	7(7)	8(8)	9(9)	10(10)	11(11)
DISTANCE			169	162	110	57	131	46	95	72	89	175	34
WEEKEND OF	7-12		2	3	1	6	1	22	+	4	4	2	8
	7-19		1	5	2	13	1	23	+	6	5	+	9
	7-26		5	8	6	10	+	34	2	13	8	1	25
	8-2		6	11	3	5	1	10	+	6	2	+	13
	8-9		1	13	1	11	4	29	+	3	4	2	8

		12(12)	13(14)	14(15)	15(16)	16(17)	17(18)	18(19)	19(20)	20(21)	21(22)	22(23)	23(25)
DISTANCE		59	112	172	127	179	112	136	161	132	173	24	112
WEEKEND OF	7-12	9	1	+	+	+	15	1	2	1	1	23	1
	7-19	21	4	+	+	1	14	+	2	+	+	32	1
	7-26	27	2	+	+	1	5	1	7	2	+	30	9
	8-2	15	2	2	2	+	7	+	5	+	+	26	2
	8-9	7	+	1	+	+	4	+	2	+	+	26	+

		24(26)	25(27)	26(28)	27(29)	28(30)	29(31)	30(32)	31(33)	32(34)	33(35)	34(36)	35(37)
DISTANCE		117	117	85	72	88	168	51	114	93	137	131	87
WEEKEND OF	7-12	7	18	5	17	5	+	16	3	10	4	+	2
	7-19	5	8	+	19	4	1	21	4	17	4	2	2
	7-26	1	6	8	20	4	+	20	19	27	4	1	2
	8-2	4	6	+	7	4	+	13	1	11	9	+	6
	8-9	3	5	6	17	1	+	41	10	8	2	+	4

TABLE 15: WEEKEND TRIPS TO TURKEY RUN STATE PARK

		COUNTY NUMBER											
		36(38)	37(39)	38(40)	39(41)	40(42)	41(43)	42(44)	43(45)	44(46)	45(47)	46(48)	47(49)
DISTANCE		143	156	131	89	91	136	193	120	148	105	92	68
WEEKEND OF	7-12	2	3	3	5	12	2	+	44	7	2	23	125
	7-19	3	+	+	7	5	9	+	55	8	+	34	155
	7-26	1	+	+	8	7	6	+	48	5	6	34	188
	8-2	4	+	1	3	4	2	1	43	11	+	12	117
	8-9	3	+	+	11	3	1	1	65	11	1	28	142
		48(50)	49(51)	50(52)	51(53)	52(54)	53(55)	54(56)	55(57)	56(58)	57(59)	58(60)	59(61)
DISTANCE		132	120	104	81	24	72	66	172	178	128	63	8
WEEKEND OF	7-12	9	1	3	6	43	12	4	2	+	+	7	77
	7-19	10	1	5	4	42	7	15	+	1	+	1	50
	7-26	2	1	1	7	35	6	4	2	+	+	4	41
	8-2	1	+	3	2	45	13	2	1	2	1	1	34
	8-9	4	1	4	3	42	5	1	2	+	+	3	44
		60(62)	61(63)	62(64)	63(65)	64(66)	65(67)	66(68)	67(69)	68(70)	69(71)	70(72)	71(73)
DISTANCE		176	113	130	166	106	36	134	150	114	155	155	106
WEEKEND OF	7-12	1	2	3	1	2	14	2	1	1	10	+	5
	7-19	1	+	6	+	+	5	3	2	1	13	1	4
	7-26	+	1	5	+	2	23	2	3	2	19	+	1
	8-2	+	1	4	+	2	10	2	1	+	4	1	1
	8-9	+	+	11	+	+	4	+	+	+	13	+	2

TABLE 15: WEEKEND TRIPS TO TURKEY RUN STATE PARK (CONTINUED)

		COUNTY NUMBER											
		72(74)	73(75)	74(76)	75(77)	76(78)	77(79)	78(80)	79(81)	80(82)	81(83)	82(84)	83(85)
DISTANCE		172	123	199	61	177	51	84	144	147	23	33	118
WEEKEND OF	7-12	3	3	+	8	+	39	5	+	7	15	50	1
	7-19	1	2	+	3	+	61	7	1	11	24	71	7
	7-26	1	3	1	1	+	69	7	2	11	18	88	1
	8-2	1	2	+	9	1	51	1	+	8	8	36	1
	8-9	+	1	+	5	+	47	1	+	4	21	53	1
		84(86)	85(87)	86(88)	87(89)	88(90)	89(91)	90(92)	COUNTIES FROM ILLINOIS	91(3)	92(4)	93(8)	94(10)
DISTANCE		31	150	140	137	152	78	154		142	230	277	64
WEEKEND OF	7-12	2	1	+	1	1	10	1		+	+	+	40
	7-19	15	+	+	2	+	5	+		+	+	+	40
	7-26	4	+	2	6	6	7	1		1	1	+	42
	8-2	2	+	+	2	2	2	1		1	+	+	20
	8-9	3	+	1	4	2	7	1		+	1	1	39
		95(11)	96(12)	97(13)	98(14)	99(15)	100(16)	101(17)	102(18)	103(19)	104(20)	105(21)	106(22)
DISTANCE		131	48	123	127	64	161	78	80	209	104	65	167
WEEKEND OF	7-12	1	1	+	+	7	54	+	1	+	+	23	8
	7-19	5	2	+	+	9	96	1	2	1	+	21	6
	7-26	2	9	+	1	8	77	5	1	+	+	25	9
	8-2	+	2	+	+	5	73	1	+	+	+	9	8
	8-9	5	4	1	+	6	72	3	+	+	1	7	7

TABLE 15: WEEKEND TRIPS TO TURKEY RUN STATE PARK (CONTINUED)

		COUNTY NUMBER											
		107(23)	108(25)	109(26)	110(27)	111(29)	112(30)	113(31)	114(34)	115(38)	116(40)	117(41)	118(45)
DISTANCE		38	98	124	77	143	198	200	240	81	264	111	177
WEEKEND OF	7-12	12	1	1	3	+	+	+	+	5	+	+	2
	7-19	9	4	+	1	1	+	+	+	6	1	+	2
	7-26	37	+	+	4	+	+	1	+	4	1	1	3
	8-2	14	+	1	2	+	+	+	+	1	2	+	6
	8-9	14	+	+	3	1	1	1	1	2	+	1	+
		119(46)	120(49)	121(50)	122(51)	123(52)	124(53)	125(54)	126(56)	127(57)	128(58)	129(59)	130(60)
DISTANCE		112	200	181	94	222	135	125	227	110	102	169	175
WEEKEND OF	7-12	6	3	1	1	+	1	+	+	12	8	+	1
	7-19	5	14	+	2	2	2	+	+	4	12	1	1
	7-26	3	3	+	2	+	2	1	1	7	18	2	2
	8-2	3	8	1	1	1	3	1	+	6	9	+	1
	8-9	6	7	1	11	+	+	+	+	7	9	1	2
		131(61)	132(62)	133(63)	134 68)	135(69)	136(70)	137(72)	138(74)	139(77)	140(80)	141(81)	142(82)
DISTANCE		143	172	172	155	178	98	152	87	291	115	256	190
WEEKEND OF	7-12	1	1	+	+	+	6	4	5	+	+	1	+
	7-19	+	+	1	+	+	8	+	1	+	+	+	+
	7-26	1	+	+	2	+	3	2	1	+	1	+	4
	8-2	1	+	2	+	+	3	1	2	+	+	+	+
	8-9	+	+	+	+	1	3	1	2	1	+	+	+

TABLE 15: WEEKEND TRIPS TO TURKEY RUN STATE PARK (CONTINUED)

		COUNTY NUMBER											
		143(84)	144(87)	145(90)	146(92)	147(93)	148(99)	149(101)	COUNTIES FROM OHIO	150(2)	151 (8)	152(9)	153(19)
DISTANCE		142	106	148	31	115	143	237		205	234	168	157
WEEKEND OF	7-12	6	+	1	81	+	4	2		+	+	3	1
	7-19	3	3	1	61	+	9	+		+	+	+	+
	7-26	5	1	2	95	1	8	1		+	1	+	+
	8-2	2	+	2	46	+	1	+		1	+	+	+
	8-9	4	+	2	65	+	4	1		+	+	+	+

		154(25)	155(29)	156(31)	157(32)	158(40)	159(42)	160(45)	161(46)	162(47)	163(48)	164(51)	165(52)
DISTANCE		248	192	182	247	292	282	278	207	339	268	252	322
WEEKEND OF	7-12	4	1	3	+	+	+	1	1	+	+	+	+
	7-19	1	+	3	+	+	+	+	+	1	1	+	+
	7-26	3	1	3	+	+	+	+	+	+	1	+	1
	8-2	+	2	2	3	+	+	+	+	+	+	1	+
	8-9	+	+	+	+	1	1	+	+	+	1	+	+

		166(55)	167(57)	168(58)	169(60)	170(65)	171 (67)	172(68)	173(74)	174(76)	175(77)	176(78)	177(83)
DISTANCE		182	176	323	296	249	372	152	273	363	357	395	190
WEEKEND OF	7-12	+	+	+	+	+	+	+	+	+	+	1	+
	7-19	+	4	+	+	+	1	+	+	+	+	+	+
	7-26	1	2	1	1	1	+	1	1	1	1	+	1
	8-2	+	+	+	+	+	1	+	+	+	+	+	+
	8-9	+	3	+	+	+	+	+	+	+	+	+	+

TABLE 15: WEEKEND TRIPS TO TURKEY RUN STATE PARK (CONTINUED)

		COUNTY NUMBER										
		COUNTIES FROM MICHIGAN	178(1)	179(9)	180(10)	181(11)	182(12)	183(13)	184(14)	185(28)	186(33)	187(38)	188(39)
DISTANCE			501	239	387	179	229	252	178	401	292	271	222
WEEKEND OF	7-12		+	2	+	+	+	1	3	+	+	1	1
	7-19		1	+	+	5	+	1	+	+	+	+	1
	7-26		+	+	+	3	1	+	+	1	+	+	3
	8-2		+	+	+	+	+	+	+	+	+	+	+
	8-9		+	+	1	+	+	+	+	+	1	+	+
			189(41)	190(50)	191(62)	192(63)	193(67)	194(70)	195(74)	196(75)	197(79)	198(81)	199(82)	COUNTIES FROM KENTUCKY
DISTANCE			257	351	308	340	327	255	384	195	400	305	328	
WEEKEND OF	7-12		1	2	+	1	+	+	+	+	+	+	+	
	7-19		+	1	+	1	+	+	+	1	+	1	1	
	7-26		+	+	+	1	2	1	+	1	+	+	2	
	8-2		1	+	+	1	+	1	2	+	1	+	1	
	8-9		1	1	1	2	+	+	+	+	+	+	1	
			200(3)	201(5)	202(8)	203(19)	204(34)	205(51)	206(56)	207(57)	208(59)	209(73)	210(86)	211(113)
DISTANCE			225	273	196	183	239	159	176	250	183	236	300	182
WEEKEND OF	7-12		1	+	+	+	+	1	+	+	1	+	+	+
	7-19		+	+	+	+	1	1	+	+	2	+	+	+
	7-26		+	1	+	1	+	+	+	1	+	+	1	1
	8-2		+	+	+	+	+	+	5	+	+	1	+	+
	8-9		+	+	2	+	+	2	+	+	+	+	+	+

TABLE 15: WEEKEND TRIPS TO TURKEY RUN STATE PARK (CONTINUED)

		COUNTY NUMBER										
		COUNTIES FROM WISCONSIN	212(5)	213(9)	214(13)	215(28)	216(30)	217(40)	218(48)	219(51)	220(54)	221(59)	COUNTIES FROM MISSOURI
DISTANCE			365	507	312	292	218	256	590	228	541	314	
WEEKEND OF	7-12		+	+	1	+	+	1	1	+	+	+	
	7-19		1	1	+	1	2	3	+	1	+	1	
	7-26		+	+	+	+	+	5	+	+	1	+	
	8-2		1	+	+	1	+	+	+	+	+	+	
	8-9		+	+	+	+	+	+	+	+	+	1	

		222(36)	223(95)										
DISTANCE		237	199										
WEEKEND OF	7-12	+	4										
	7-19	1	5										
	7-26	+	4										
	8-2	+	1										
	8-9	+	1										

DISTANCE													
WEEKEND OF	7-12												
	7-19												
	7-26												
	8-2												
	8-9												

TABLE 15: WEEKEND TRIPS TO TURKEY RUN STATE PARK (CONCLUDED)

APPENDIX B

TABLE 16: NUMERICAL CODE LIST - ILLINOIS COUNTIES

1	Adams	25	Ettingham	49	Lake
2	Alexander	26	Fayette	50	La Salle
3	Bond	27	Ford	51	Lawrence
4	Boone	28	Franklin	52	Lee
5	Brown	29	Fulton	53	Livingston
6	Bureau	30	Gallatin	54	Logan
7	Calhoun	31	Greene	55	McDonough
8	Carroll	32	Grundy	56	McHenry
9	Cass	33	Hamilton	57	McLean
10	Champaign	34	Hancock	58	Macon
11	Christian	35	Hardin	59	Macoupin
12	Clark	36	Henderson	60	Madison
13	Clay	37	Henry	61	Marion
14	Clinton	38	Iroquois	62	Marshall
15	Coles	39	Jackson	63	Mason
16	Cook	40	Jasper	64	Massac
17	Crawford	41	Jefferson	65	Menard
18	Cumberland	42	Jersey	66	Merien
19	DeKalb	43	Jo Daviess	67	Monroe
20	DeWitt	44	Johnson	68	Montgomery
21	Douglas	45	Kane	69	Morgan
22	DuPage	46	Kankakee	70	Boultrie
23	Edgar	47	Kendall	71	Ogle
24	Edwards	48	Knox	72	Pedria

TABLE 16: NUMERICAL CODE LIST - ILLINOIS COUNTIES (Continued)

73	Perry	83	Saline	93	Wabash
74	Piatt	84	Sangamon	94	Warren
75	Pike	85	Schuyler	95	Washington
76	Pope	86	Scott	96	Wayne
77	Pulaski	87	Shelby	97	White
78	Putnam	88	Stark	98	Whiteside
79	Randolph	89	Stephenson	99	Will
80	Richland	90	Tazewell	100	Williamson
81	Rock Island	91	Union	101	Winebago
82	St. Clair	92	Vermilion	102	Woodford

TABLE 17: NUMERICAL CODE LIST - INDIANA COUNTIES

1	Adams	25	Fulton	49	Marion
2	Allen	26	Gibson	50	Marshall
3	Bartholomew	27	Grant	51	Martin
4	Benton	28	Greene	52	Miami
5	Blackford	29	Hamilton	53	Monroe
6	Boone	30	Hancock	54	Montgomery
7	Brown	31	Harrison	55	Morgan
8	Carroll	32	Hendricks	56	Newton
9	Cass	33	Henry	57	Noble
10	Clark	34	Howard	58	Ohio
11	Clay	35	Huntington	59	Orange
12	Clinton	36	Jackson	60	Owen
13	Crawford	37	Jasper	61	Parke
14	Daviess	38	Jay	62	Perry
15	Dearborn	39	Jefferson	63	Pike
16	Decatur	40	Jennings	64	Porter
17	DeKalb	41	Johnson	65	Posey
18	Delaware	42	Knox	66	Pulaski
19	Dubois	43	Kosciusko	67	Putnam
20	Elkhart	44	LaGrange	68	Randolph
21	Fayette	45	Lake	69	Ripley
22	Floyd	46	LaPorte	70	Rush
23	Fountain	47	Lawrence	71	St. Joseph
24	Franklin	48	Madison	72	Scott

TABLE 17: NUMERICAL CODE LIST - INDIANA COUNTIES (Continued)

73	Shelby	80	Tipton	87	Warrick
74	Spencer	81	Union	88	Washington
75	Starke	82	Vanderburgh	89	Wayne
76	Steuben	83	Vermillion	90	Wells
77	Sullivan	84	Vigo	91	White
78	Switzerland	85	Wabash	92	Whitley
79	Tippecanoe	86	Warren		

TABLE 18: NUMERICAL CODE LIST - KENTUCKY COUNTIES

1	Adair	25	Clark	49	Harrison
2	Allen	26	Clay	50	Hart
3	Anderson	27	Clinton	51	Henderson
4	Ballard	28	Crittenden	52	Henry
5	Baren	29	Cumberland	53	Hickman
6	Bath	30	Daviess	54	Hopkins
7	Bell	31	Edmonson	55	Jackson
8	Boone	32	Elliott	56	Jefferson
9	Bourbon	33	Estill	57	Jessamine
10	Boyd	34	Fayette	58	Johnson
11	Boyle	35	Fleming	59	Kenton
12	Bracken	36	Floyd	60	Knott
13	Breathitt	37	Franklin	61	Knox
14	Breckinridge	38	Fulton	62	Larue
15	Bullitt	39	Gallatin	63	Laurel
16	Butler	40	Garrard	64	Lawrence
17	Caldwell	41	Grant	65	Lee
18	Calloway	42	Graves	66	Leslie
19	Compbell	43	Grayson	67	Letcher
20	Carlisle	44	Greene	68	Lewis
21	Carroll	45	Greenup	69	Lincoln
22	Carter	46	Hancock	70	Livingston
23	Casey	47	Hardin	71	Logan
24	Christian	48	Harlan	72	Lyon

TABLE 18: NUMERICAL CODE LIST - KENTUCKY COUNTIES (Continued)

73	McCracken	89	Muhlenberg	105	Scott
74	McCreary	90	Nelson	106	Shelby
75	McLean	91	Nicholas	107	Simpson
76	Madison	92	Ohio	108	Spencer
77	Magoffin	93	Oldham	109	Taylor
78	Marion	94	Owen	110	Todd
79	Marshall	95	Owsley	111	Trigg
80	Martin	96	Pendleton	112	Trimble
81	Mason	97	Perry	113	Union
82	Meade	98	Pike	114	Warren
83	Menifee	99	Powell	115	Washington
84	Merier	100	Polaski	116	Wayne
85	Metcalfe	101	Robertson	117	Webster
86	Monroe	102	Rockcastle	118	Whitley
87	Montgomery	103	Rowan	119	Wolfe
88	Morgan	104	Russell	120	Woodord

TABLE 19: NUMERICAL CODE LIST - MICHIGAN COUNTIES

1	Alcona	25	Genesse	49	Mackinac
2	Alger	26	Gladwin	50	Macomb
3	Allegan	27	Gogobic	51	Manistee
4	Alpena	28	Grand Traverse	52	Marzuette
5	Antrim	29	Gratiot	53	Mason
6	Arenac	30	Hillsdale	54	Mecosta
7	Baraga	31	Houghton	55	Menominee
8	Barry	32	Huron	56	Midland
9	Bay	33	Ingham	57	Missaukee
10	Benzie	34	Ionia	58	Monroe
11	Berrien	35	Iosco	59	Montcalm
12	Branch	36	Iron	60	Montmorency
13	Calhoun	37	Isabella	61	Muskegon
14	Cass	38	Jackson	62	Newaygo
15	Charlevoix	39	Kalamazoo	63	Oakland
16	Cheboygan	40	Kalkaska	64	Oceana
17	Chippewa	41	Kent	65	Ogemaw
18	Clare	42	Keweenaw	66	Ontonagon
19	Clinton	43	Lake	67	Osceola
20	Crawford	44	Lapeer	68	Oscoda
21	Delta	45	Leelanav	69	Otsego
22	Dickinson	46	Lenawee	70	Ottawa
23	Eaton	47	Livingston	71	Presque Isle
24	Emmet	48	Luce	72	Roscommon

TABLE 19: NUMERICAL CODE LIST - MICHIGAN COUNTIES (Continued)

73	Saginaw	77	Schoolcraft	81	Washtenaw
74	St. Clair	78	Shiawasse	82	Wayne
75	St. Joseph	79	Tuscola	83	Wexford
76	Sanilac	80	Van Buren		

TABLE 20: NUMERICAL CODE LIST - MISSOURI COUNTIES

1	Adair	25	Clinton	49	Jasper
2	Andrew	26	Cole	50	Jefferson
3	Atchison	27	Cooper	51	Johnson
4	Audrain	28	Crawford	52	Knox
5	Barry	29	Dade	53	Laclede
6	Barton	30	Dallas	54	Lafayette
7	Bates	31	Daviess	55	Lawrence
8	Benton	32	De Kalb	56	Lewis
9	Bollinger	33	Dent	57	Lincoln
10	Boone	34	Douglas	58	Linn
11	Buchanan	35	Dunklin	59	Livingston
12	Butler	36	Franklin	60	McDonald
13	Caldwell	37	Gasconade	61	Macon
14	Calaway	38	Gentry	62	Madison
15	Camden	39	Greene	63	Maries
16	Cape Girardeau	40	Grundy	64	Marion
17	Carroll	41	Harrison	65	Mercer
18	Carter	42	Henry	66	Miller
19	Cass	43	Hickory	67	Mississippi
20	Cedar	44	Holt	68	Moniteau
21	Chariton	45	Howard	69	Monroe
22	Christian	46	Howell	70	Montgomery
23	Clark	47	Iron	71	Morgan
24	Clay	48	Jackson	72	New Madrid

TABLE 20: NUMERICAL CODE LIST - MISSOURI COUNTIES (Continued)

73	Newton	88	Randolph	102	Shannon
74	Nodaway	89	Ray	103	Shelby
75	Oregon	90	Reynolds	104	Stoddard
76	Osage	91	Ripley	105	Stone
77	Ozark	92	St. Charles	106	Sullivan
78	Pemiscot	93	St. Clair	107	Taney
79	Perry	94	St. Francois	108	Texas
80	Pettis	95	St. Louis	109	Veron
81	Phelps	96	St. Louis City	110	Warren
82	Pike	97	Ste. Genevieve	111	Washington
83	Platte	98	Saline	112	Wayne
84	Polk	99	Schuyler	113	Webster
85	Pulasri	100	Scotland	114	Worth
86	Putnam	101	Scott	115	Wright
87	Ralls				

TABLE 21: NUMERICAL CODE LIST - OHIO COUNTIES

1	Adams	25	Franklin	49	Madison
2	Allen	26	Fulton	50	Mahoning
3	Ashland	27	Gallia	51	Marion
4	Ashtabula	28	Geauga	52	Medina
5	Athens	29	Greene	53	Meigs
6	Auglaize	30	Guernsey	54	Mercer
7	Belmont	31	Hamilton	55	Miami
8	Brown	32	Hancock	56	Monroe
9	Butler	33	Hardin	57	Montgomery
10	Carroll	34	Harrison	58	Morgan
11	Champaign	35	Henry	59	Morrow
12	Clark	36	Highland	60	Muskingum
13	Clermont	37	Hocking	61	Noble
14	Clinton	38	Holmes	62	Ottawa
15	Columbiana	39	Huron	63	Paulding
16	Coshocton	40	Jackson	64	Perry
17	Crawford	41	Jefferson	65	Pickaway
18	Cuyahoga	42	Knox	66	Pike
19	Darke	43	Lake	67	Portage
20	Defiance	44	Lawrence	68	Preble
21	Delaware	45	Licking	69	Putnam
22	Erie	46	Logan	70	Richland
23	Fairfield	47	Lorain	71	Ross
24	Fayette	48	Lucas	72	Sandusky

TABLE 21: NUMERICAL CODE LIST - OHIO COUNTIES (Continued)

73	Scioto	79	Tuscarawas	85	Wayne
74	Seneca	80	Union	86	Williams
75	Shelby	81	Van Wert	87	Wood
76	Stark	82	Vinton	88	Wyandot
77	Summit	83	Warren		
78	Trumbull	84	Washington		

TABLE 22: NUMERICAL CODE LIST - WISCONSIN COUNTIES

1	Adams	25	Iowa	49	Portage
2	Ashland	26	Iron	50	Price
3	Barron	27	Jackson	51	Racine
4	Bayfield	28	Jefferson	52	Richland
5	Brown	29	Juneau	53	Rock
6	Buffalo	30	Kenosha	54	Rusk
7	Burnett	31	Kewaunee	55	St. Croix
8	Calumet	32	La Crosse	56	Saulk
9	Chippewa	33	Lafayette	57	Sawyer
10	Clark	34	Langlade	58	Shawand
11	Columbia	35	Lincoln	59	Sheboygan
12	Crawford	36	Manitowac	60	Taylor
13	Dane	37	Marathon	61	Trempealeau
14	Dodge	38	Marinette	62	Vernon
15	Door	39	Marquette	63	Vilas
16	Douglas	40	Milwaukee	64	Walworth
17	Dunn	41	Monroe	65	Washburn
18	Eau Claire	42	Oconto	66	Washington
19	Florence	43	Oneida	67	Waukesha
20	Fond du Lac	44	Outagamie	68	Waupaca
21	Forrest	45	Ozaukee	69	Waushara
22	Grant	46	Pepin	70	Winnebago
23	Greene	47	Pierce	71	Wood
24	Green Lake	48	Polk		

APPENDIX C

DESCRIPTION OF STATE RECREATIONAL AREAS

A state park is by definition a "relatively spacious area of outstanding scenic or wilderness character, often times containing significant historical, archeological, ecological, geological, and other scientific values, preserved as nearly as possible in their original or natural condition and providing opportunity for appropriate types of recreation where such will not destroy or impair the features and values to be preserved" (29). The Indiana State Parks System was established in 1916 when McCormick's Creek and Turkey Run were founded. The original land acquisitions were based on the above definition but in recent years more emphasis has been placed on the provision of the recreational facilities for concentrations of population, than in the concern with outstanding landscape or historical significance. A description of the twenty areas presently in the Indiana State Park System follows.

A. BASS LAKE STATE BEACH - A twenty-one acre tract on the shore of Indiana's fourth largest lake providing excellent swimming and fishing facilities. The park is located on Indiana 10, near Knox.

B. BROWN COUNTY STATE PARK - Largest of Indiana's parks with 15,332 acres of wooded hill land, it is famed for its brilliant fall coloring and is the inspiration of artists the world over. A former state game preserve, now part of the Park, provides lakes, streams, and miles of drives and trails. The Park is located on Indiana 46 and 135, near Nashville.

C. CHAIN O'LAKES STATE PARK - This 1,920 acre park located on Indiana 9 near Albion is presently under development.

D. CLIFTY FALLS STATE PARK - Situated on the Ohio River, the Park offers visitors a breath-taking view of the River, the paddle-wheel steamboats, and the haze-hung hills of the Kentucky shore.

The falls of Clifty Creek and Little Clifty Creek and the deep boulder-strewn canyon into which the sun shines only at mid-day are several of the attractions found within its 668 acres of scenic beauty. The park is located on Indiana 107 and 56, near Madison.

E. INDIANA DUNES STATE PARK - The summer playground for many people each year, this park is situated along three miles of fine, white sand on Lake Michigan. The Park is noted chiefly for the numerous sand dunes, both moving and fixed, which occur in that region and it is one of the few places where the sand dunes have been preserved for the public. Behind the dunes are densely forested areas, including a large section of marsh land. The area is also abundently covered with numerous varieties of midwestern trees and shrubs providing 2,182 acres of diversified beauty. The Park is located on Indiana 12 and 49, near Chesterton.

F. KANKAKEE RIVER - The 1,794 acres of this Park are situated in the vast Kankakee Swamp which was once a famous wild-life area. Partly drained for agricultural purposes, the area has the potential of becoming a renowned wild-life refuge and fishing ground. The Park is located on U. S. 41, near Schneider.

G. LIEBER STATE PARK - An 8,248 acre area leased to the Indiana Department of Conservation by the United States Army Corps of Engineers, the Park is located on Indiana 42, near Cloverdale.

H. LINCOLN STATE PARK - A tribute to Abraham Lincoln, this Park of 1,622 acres, is located on the land where Lincoln spent fourteen years as a boy and young man. Containing winding trails and drives, it provides many attractive sights. The Park is located on Indiana 162, near Lincoln City.

I. MCCORMICK'S CREEK STATE PARK - The first of Indiana's State Parks, it is chiefly noted for the low falls in McCormick's Creek and the large limestone canyon eroded by the Creek to connect the falls with the White River. Along the Creek there are foot trails, bridle paths, and roads on which to explore the forests, ravines, sink holes, deep stone gullies, and abandoned quarry. This 1,225 acre Park is located on Indiana 46, near Spencer.

J. MOUNDS STATE PARK - Bordering on the White River, this Park was set aside to preserve the rare examples of the prehistoric Mound Builder's work. The largest work consists of a great earthen mound encircled by an earthen wall 1200 feet in circumference and 9 feet high. The area is heavily wooded, and its 254 acres contains several other smaller examples of this prehistoric civilization. The Park is located on Indiana 32, near Anderson.

K. POKAGON STATE PARK - Rapidly becoming known as a "year 'round playground," both summer and winter sports enthusiasts can find numerous recreational activities on the 956 acres of this Park which is located on U. S. 27, near Angola.

L. RACCOON LAKE STATE RECREATIONAL AREA - Opened in July of 1961, this 3,938 acre Park contains a 600 acre peninsula jutting into the Raccoon Lake Flood Control Reservoir, a body of water which has a summer surface area of 2100 acres. Its particular location makes the reservoir the focal point of its activity and allows an abundance of water oriented activities. The area is located on U. S. 44, near Hollandsburg.

M. SCALES LAKE STATE BEACH - A former State Forest which is now being administered as a recreation area, the area is composed of 477 acres of a one-time strip mine. The Park is located on U. S. 460, near Boonville.

N. SHADES STATE PARK - This Park's 2,570 acres of rugged terrain along Sugar Creek is famous for its appeal to the hiker who seeks to explore the deep sandstone gorges and quiet trails through virgin woods. The Park is located on Indiana 234, near Waveland.

O. SHAKAMAK STATE PARK - Located in the heart of the Indiana coal mining area, this Park's two artificial lakes compose the center of its activity. Enroute to the Park, motorists may observe the strip-mining of coal, while within Shakamak's 1,016 rustic acres is a small mine in which one can see coal in its natural state. The park is located on Indiana 48 and 159, near Jasonville.

P. SPRING MILL STATE PARK - This area is noted for its reconstructed pioneer village including the original water powered grist mill, the reconstructed saw mill, buildings housing the various industries of the town and many of the original residences. Aside from the village, there are many large caves in the area with provisions for guided boat trips or exploration on foot. This Park's 1,210 scenic acres are located on Indiana 60, near Mitchell.

Q. TIPPECANOE RIVER STATE PARK - Stretching for eight miles along the Tippecanoe River, this Park covers 2,743 acres. The area contains extensive group camping facilities and is located on U. S. 35, near Winamac.

R. TURKEY RUN STATE PARK - The second Park established in Indiana, this area is chiefly noted for its geological formations and rugged canyons formed during the glacial periods. Its 1,740 acres provide a diversified number of group and individual activities. The Park is located on Indiana 47, near Marshall.

S. VERSAILLES STATE PARK - Widely known among sportsmen throughout Indiana and the adjoining States for the excellent field running grounds, the 5,858 acres of this Park stradle Loughery and Fatten Timber Creeks. The Park is located on Indiana 29 and U. S. 50, near Versailles.

T. WHITEWATER STATE PARK - This area which contains 1,515 acres, including a 200 acre lake, is now under development. The Park is located on Indiana 44, near Liberty.

APPENDIX D

TABLE 23: VARIABLES USED IN THE REGRESSION ANALYSIS - LISTED IN ORDER OF IMPORTANCE

Variable No.	Variable Name
1	Number of picnic tables
2	Number of campsites
3	Area of lakes
4	Acres of the park intensively developed
5	Availability of flush toilets
6	Bathhouse on premises
7	Number of cabin rooms
8	Area of picnic shelters
9	Total capacity of guest-living facilities
10	Lectures given
11	Beach available
12	Fishing permited
13	Availability of showers
14	Naturalist Service available
15	Water front located on premises
16	Number of foot trails marked
17	Location on river
18	Availability of electricity
19	Population within 60 miles of the park
20	Availability of pit toilets
21	Availability of laundry tubs
22	Number of rooms in the Inn
23	Dining room capacity

TABLE 23 (Continued)

Variable No.	Variable Name
24	Recreation field on premises
25	Availability of fire wood
26	Concessions provided
27	Total acreage of the park
28	Drinking water provided
29	Number of private baths
30	Miles of park drives
31	Bridle trails provided
32	Saddle barn on premises
33	Water skiing allowed
34	Wildlife exhibits
35	Playground equipment available
36	Population within 10 miles of the park
37	Availability of hot water
38	Tennis and other games
39	Population within 30 miles
40	Boat launching sites available
41	Pool on premises
42	Archery course
43	Museum on premises
44	Swimming allowed
45	Capacity of group camps
46	Hiking conducted
47	Bicycles rented
48	Boats rented